**Holembovska N.V., Kryzhova Y.P., Bal-Prylypko L.V., Slobodyanyuk N.M., Israelian V.M., Rozhkov Yu.G., Androschuk O.S., Dorozhko V.V.**

# SENSORY ANALYSIS

## Basic Textbook

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The textbook's content corresponds to the curriculum of the discipline "Sensory analysis". The textbook will be helpful to students, postgraduates and teachers of higher education institutions.

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# PREFACE

A person's perception of the surrounding world, including food, is formed as a result of the analysis of information received from the receptors of individual sense organs. To assess the quality of food products, the organs of sight, taste, smell, touch, and rarely hearing are used, which provide information about the appearance, taste, smell, consistency, and sound that occurs during mechanical destruction of the product.

Sensory properties of almost all the main products of the food industry are currently being studied, namely: subtropical products, seasonings, spices, vegetable and fruit and berry crops, confectionery and alcoholic products, meat, dairy and fish products.

In recent years, consumer demand for products made from meat and aquatic biological resources (fish, invertebrates, algae) has been growing, due not only to their high nutritional and physiological value, but also to their unique organoleptic properties. The formation and preservation of organoleptic properties over time is one of the primary tasks of food technology, in the solution of which an important role is played by knowledge of the mechanisms of psychophysiological perception by humans of smell, taste, color and structural and mechanical properties of food products; establishing the relationship between physical parameters, chemical composition of the product and its organoleptic properties; detection of a clear correlation between the results of sensory tests and instrumental evaluation of samples and the creation of intelligent analytical systems.

Therefore, the purpose of the manual is to provide an opportunity for students of higher education to develop theoretical knowledge, skills and abilities regarding the functioning of human sensory systems; study of the methodology and basic methods of scientifically based tasting analysis and their use for evaluating the quality of food products.

The manual is prepared taking into account the requirements of the curriculum and the student training program for studying the disciplines "Sensory analysis", "Modern methods of industry research", "Technology of meat and meat products" and "Technology

of fish and fish products".

The materials of the manual are illustrated with numerous figures and tables. Some of them are borrowed from literary sources, and others are prepared by the authors of the manual.

The manual covers the main concepts, definitions, and terminology related to sensory analysis; requirements for premises for sensory analysis, which ensure good reproducibility of the results of sensory studies, and possible sources of error in sensory analysis of food products; the influence of various factors on the perception of the organoleptic properties of a food product and the physiology of sensation formation; scientifically based methods of sensory analysis and their application for sensory analysis of food products, the organoleptic indicators of the meat of slaughtered animals, poultry, and their definition are given; organoleptic indicators, their characteristics for sausage products, semi-finished products, and canned goods are given; methods of determining the organoleptic indicators of raw materials and products from hydrobionts are given.

The guide was developed for students of specialty 181 "Food technologies", postgraduate students and specialists, as well as for scientific and engineering workers of research institutions and processing enterprises of the meat and fish industry.

# CHAPTER 1. GENERAL PROVISIONS OF SENSORY ANALYSIS

*Topic 1.1. Sensory analysis, its importance in assessing the quality of food products*

## 1.1.1. Introduction to science

Sensory analysis is a quality assessment conducted by experts who were tested for sensory abilities and vision, which guarantee the accuracy and reproducibility of the results.

Sensory evaluation, carried out with the help of human senses, is the oldest and most common way of determining the quality of food products. Modern methods of laboratory analysis are more complex and time-consuming compared to organoleptic evaluation and allow characterizing individual quality features. Organoleptic methods quickly, objectively and reliably give a general assessment of the products quality. Sensor control allows you to quickly and purposefully influence all stages of the technological processes of food production.

Scientifically organized organoleptic sensitivity analysis is far superior to laboratory tests, especially when determining such indicators as taste, smell and consistency. Mistakes occur with an unprofessional approach to sensory methods of product evaluation.

The prevailing perception of the subjectivity and irreproducibility of organoleptic evaluations is mainly attributed to the neglect of individual taster characteristics, lack of specialized training in sensory analysis techniques, failure to adhere to the basic rules and conditions of scientifically based organoleptic methods, including the omission of testing tasters' sensory abilities, non-compliance with room requirements for sensory tests, and insufficient attention to the selection of the evaluation method.

The science of "organoleptics" was formed in the second half of the 20th century. Its developments are effectively used in European countries during the creation of new products, food additives, including flavor intensifiers, as well as for forecasting the sales markets of goods during the assessment of the acceptability of

new products, flavorings, non-traditional forms of food for the population.

The professional knowledge of an expert taster, who has modern methods of organoleptic testing of food products, is of great importance when conducting sensory analysis.

According to D.E. Tilgner, the first methodical developments in the selection of tasters were created in the USA in the 30s of the last century. In 1945, a private school for training tasters for companies producing food products was opened in Boston. In England, since the second half of the last century, serious attention has been paid to the issue of the scientific organization of the training of tasters. These studies are coordinated by the British Institute for Standardization. In France, sensory analysis methods are being developed at the Institute of Biological Problems of Nutrition and the Food Industry at the University of Dijon.

The main focus in these developments is on the principles and methods of selecting tasters. The most necessary quality indicators when selecting tasters are their high sensory abilities. The concept of sensory minimum was introduced by D.E. Tilgner in 1957. His book Organoleptic Analysis of Foodstuffs, published in 1962, was the first solid scientific work on sensory analysis.

In France, Germany, Denmark, Spain, Poland, Estonia, the Czech Republic, Slovakia and other countries, national standards have been developed for the selection of tasters, equipment for sensory analysis laboratories, terminology, and the use of scientifically based methods. As an illustration, the Polish standard incorporates test conditions for sensory minimum, while the Estonian standard, developed by psychologist G.A. Voxom at the University of Tartu, includes attestation of competence concurrently with the selection of tasters.

In 1985, international standards were approved for Eastern European countries regarding the conditions for organoleptic assessment, terminology and methods of sensory abilities of tasters evaluation.

In the scientific and research industry institutes of the USA, England, Canada, France and other countries, problem laboratories

were created that are engaged in improving the methods of assessing the quality of food products, selecting and training tasters, and conducting sensory analysis of food products.

Many European countries, in order to unify methods of organoleptic analysis, apply the recommendations of the International Organization for Standardization ISO, which is constantly working on the creation and improvement of scientifically based methods and conditions of sensory analysis of products, which contribute to the development of trade and international economic cooperation.

In Ukraine, the first experiments on improving the taste sensitivity of tasters were conducted by E.P. Barysheva in 1924, and the training of the olfactory analyzer of tasters by I.M. Kiselyovsky in 1931. The period of more active development refers to 1970-1980. Under the leadership of G.L. Solntseva a method of selecting tasters for the meat processing industry and a 9-scoring scale for evaluating the quality of meat products were created. Test programs for tasters of the fish processing industry were developed by T.M. Safronova, under the leadership of A.I. Chebotaryov methodical guide for the selection and training of tasters for the dairy industry was written. L.I. Puchkova worked on improving methods of organoleptic testing of bakery products.

The commission under the Scientific and Technical Terminology Committee of the Academy of Sciences of the USSR was headed by R.V. Holovnia. Developed by the commission and widely discussed among specialists, 78 terms were published in 1990 in the collection of scientific terminology, which includes general concepts, qualitative and quantitative organoleptic characteristics, sensory methods of evaluating food products, and terms characterizing the individual characteristics of tasters' sensitivity.

Scientific centers of methodology, standardization of organoleptics and methods of training tasters were formed and are functioning in the country. Priority developments in the field of organoleptic analysis were carried out at the All-Russian Research Institute of the Meat Industry, the Institute of Food Substances, Dalrybvtuz, the Scientific and Production Association of Food-

Centered Industry and Special Food Technology, and a number of other organizations.

The development of sensory methods is primarily necessary for commodity scientists, whose main function is to study issues related to the quality of consumer goods. Technological food branches of science also feel an urgent need for express analyzes of organoleptic properties of food ingredients and finished products.

Psychophysiological sensory analyzers of tasters are researched by psychologists and specialists dealing with human physiology.

Human sensory analyzers include:

– organs (eyes, nose, tongue, ears) that perceive the influence of light, smell, taste, sound and create nerve impulses;

- nerves that conduct impulses to the cerebral cortex that are perceived by sensitive receptors in the sense organs;

- groups of nerve cells in the centers of the cerebral cortex, where the psychological analysis of impulses takes place, which makes it possible to distinguish colors, smells, tastes, textures, and sounds. In fig. 1.1. perception centers in the cerebral cortex are depicted.

Analytical methods have been developed for testing sensory analyzers, for example, organs of sight, smell, and taste, which allow to determine with high accuracy the taster's ability to distinguish colors, smells, types and intensity of taste, to differentiate sensory sensations.

**According** to scientists, sensory reactions for individual human senses differ in duration and are: for vision 0.013–0.045 s; hearing 0.0127–0.0215 s; touch 0.0024–0.0089 s; of taste 0.0015–0.004 s.

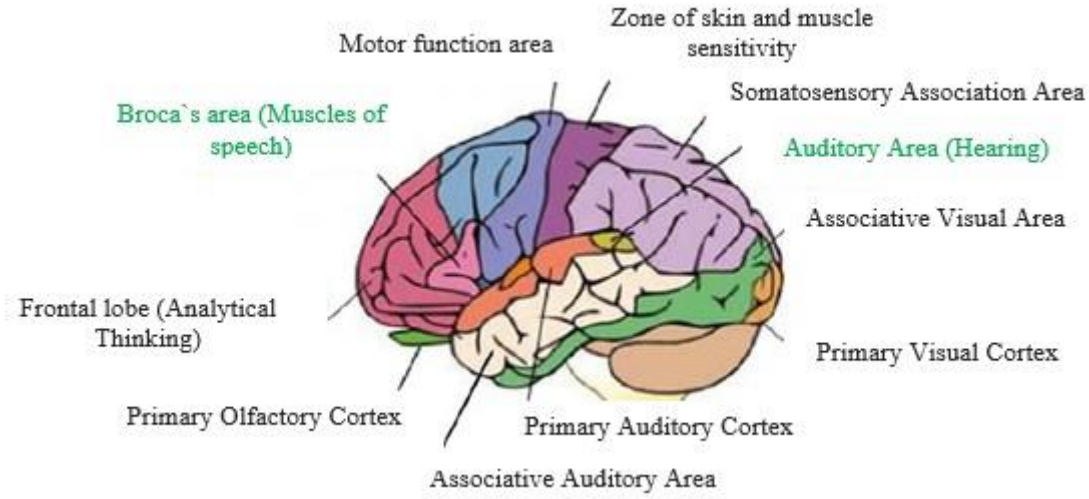



Fig. 1.1. Centers of perception in the cerebral cortex

The time during which the sensation from the impact of the impulse persists is also different for different sense organs. For example, visual sensations persist much longer, even if you close your eyes or turn away from the studied object, and the olfactory organ stops smelling if its source is removed. With sharp cooling of taste, smell or touch receptors, the corresponding impulses may not be perceived. Alcohol, nicotine, drugs, numbing the brain, negatively affect sensory analyzers.

The basis of organoleptics is also natural science fields that study the chemistry of food, the nature of flavoring substances, texture and other physical parameters of products using instrumental methods.

An important function in the development of the science of organoleptics is performed by mathematics, since statistical methods of tasting evaluation provide confidence in their reliability and reliability of tasting evaluations.

In the structure of food of the XXI century. along with traditional and modified natural products, food and biologically active additives (nutraceuticals) are used. The problem of ensuring food safety is becoming especially relevant in modern conditions. Harmful substances can enter food products from new sources of raw

materials, the environment (contaminants), as well as when adding food additives introduced according to the cooking technology, mainly to improve the organoleptic properties of products.

Safety indicators are regulated by sanitary rules and regulations, standards, normative documents. When certifying food products, it is necessary to investigate substances potentially dangerous to health (chemical pollutants, toxins), microbiological indicators, parasitic purity of products of animal origin, for example, meat.

The indicators of "taste" and "smell" are stipulated by standards and other regulatory materials characterizing the quality of products, and are mandatory requirements that ensure the safety of life and health of the population. However, not all specialists who identify the quality of food products have sufficiently sensitive sensory analyzers capable of detecting weak shades that spoil the smell and taste, which can serve as a sign of poor food quality. Mastering the methods of modern sensory analysis will contribute to increasing the efficiency of the work of food industry specialists.

### 1.1.2. Visual sensations, their perception and definition

Sight is one of the most important human tools that communicates with the outside world. In addition, sight is also the taster's most important tool. Thanks to the sight, the taster can assess the integrity of the product, its shape, degree of roasting, color, age of the wine and degree of its oxidation, etc. Sight gives a lot of information for evaluating the quality of a product.

The human eye is a complex optical system. The human eye can deviate by 60% to both sides from the central position and by 40º up and down. A simplified schematic representation of the human eye in a longitudinal section is shown in fig. 1.2 and includes the conjunctiva, cornea, iris, and pupil.

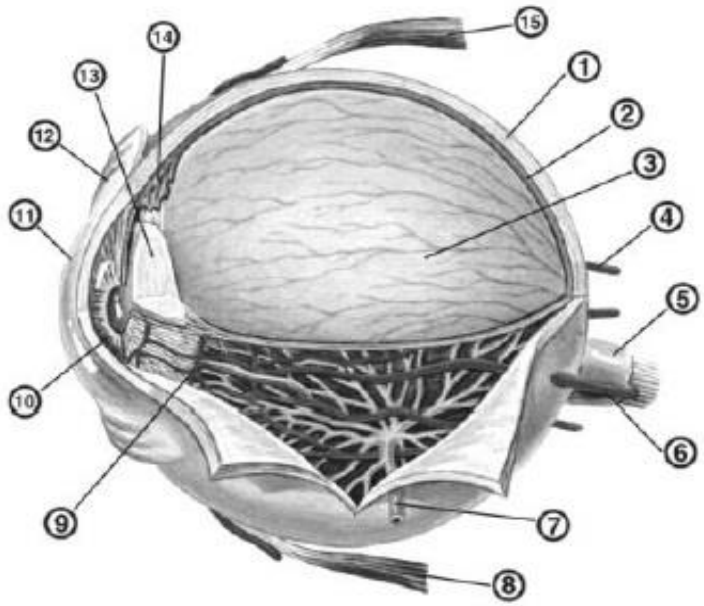



Fig. 1.2. Schematic image of the eye:
1 – sclera; 2 – vascular membrane itself; 3 – retina; 4 – short posterior artery of eyelashes; 5 – optic nerve; 6 – long posterior artery of eyelashes; 7 – vortex artery; 8 – lower rectus muscle; 9 – large arterial circle of the iris; 10 - iris; 11 – cornea; 12 – conjunctiva; 13 – lens; 14 – eyelash body; 15 – upper rectus muscle

The iris can be brown, gray, green, blue and other colors depending on the coloring pigment. The size of the pupil can change like a camera lens: in the light the pupil narrows, in the dark it expands.

The cornea and conjunctiva are covered with a thin film of tear fluid, which is formed in the lacrimal glands located in the outer part of the eye socket. Tear fluid contains enzymes that destroy bacteria, thereby protecting the eye from infection.

The cornea, anterior chamber, and iris make up the front part of the dioptric apparatus. Directly behind the iris is the back camera of the eye and the biconvex lens - the crystalline lens. The space behind the lens is filled with a vitreous body. The back inner surface is lined with the retina, which consists of a layer of pigment cells,

receptors and nerve cells.

In daylight, a person's visual acuity is maximal and depends on the degree of illumination. A person has dark and light adaptation in time: we all notice that leaving a dark cinema, we are blinded by bright light at first or, conversely, when leaving a lit room in the evening to a dark street, we see almost nothing at first.

All colors can be divided into colored (chromatic) and non-colored (achromatic). There are no natural substances whose color corresponds only to a narrow part of the spectrum. Human perception of the color of the surfaces of objects can be characterized by color tone (light wavelength), saturation (paleness) and brightness (ability to reflect or transmit light). All existing colors either correspond to a specific color in the visible solar color spectrum, or are created by mixing several colors (orange - yellow and red, blue - white and blue, etc.).

The perception of color differs due to cultural characteristics and traditions of understanding. Yes, in some languages many colors known to us simply do not have a name. In the Ukrainian language, for example, there are two different words - "blakytnyi" and "synii", while in English only one word is used for blue colors. The Eskimos, on the contrary, have about 20 concepts denoting different shades of snow, while they simply do not have the word "white".

Color perception can also depend on other factors: environment, qualifications and experience of the taster, lighting, surface type of the evaluated object, etc. Proper preparation of tastings and samples excludes the possibility of subjective evaluations.

In addition, the ability to perceive color changes with age, as yellow pigment accumulates in the lens and retina of the eye, which leads to a gradual weakening of the perception of blue.

With the help of vision, the following defects can be detected: burntness, oxidation, turbidity, sediment and various inclusions, dullness of products.

The sensitivity of the taster's visual impressions increases with observance of the tasting conditions, correct preparation of samples and tasting dishes: it is unlikely that even an experienced and

qualified taster will be able to correctly assess the color of cooked sausage on a dark plate when illuminated by an incandescent lamp.

Tasters use either specific names of colors and their combinations (red, green, yellow, white, red-brown, yellow-green), or their associations with any impressions from objects in the surrounding world (turquoise, emerald, cherry, crimson), heavenly-blue). Associative terms can have different meanings for tasters: for example, carrot color for one taster is pure orange, for another it is orange-yellow, for a third it is orange-red. Therefore, it is customary that special color terms are to be indicated unequivocally in the regulatory documentation, tasting letters, and expert opinions.

During the tasting, it should be taken into account that the color of the product affects both the general perception of quality and the perception of taste. Thus, intensively colored red wines can be perceived by the taster as an intense rich bouquet, and pale colored with a greenish tint - as liquid, diluted.

### 1.1.3. Sense of smell, its perception and definition

As it was said earlier, a person is quite limited in the perception of tastes - due to anatomical features, he/she can recognize only sweet, salty, sour, bitter tastes. All other combinations of flavors - green apple, oysters, smoked fish, pineapple, juicy chicken, fried bacon - are felt by the sense of smell. A person suffering from a runny nose is deprived of the ability to experience the variety of flavors of food and, therefore, the ability to enjoy food.

The sense of smell is the most complex mechanism in the human body, which still retains many secrets and allows for communication between the smell, the brain and emotional feelings of a person. The taster's olfactory abilities allow him/her to comprehensively evaluate not only the smell or aroma of the product being evaluated, but also the taste (flavor), the quality of the product as a whole.

A person can feel thousands of smells, but compared to animals, his olfactory abilities are very modest.

In the process of evolution, having stopped using the sense of

smell to find food and save life in times of danger, man also lost the ability to verbally describe aromas. There is an explanation for this - because the speech center and the limbic system, which is responsible for the perception of aromas, are located in different hemispheres of the brain in humans and practically do not communicate with each other.

Today, people use rather poor descriptions of aromas, resorting to their taste and color characteristics or analyzing their emotional perception of the aroma: sweet, bitter, sour, blue, bright, familiar, gentle, delicate, refined, loud, chic, spicy, sonorous, daring, sexual etc. Perfumers use musical terms: fragrance leitmotif, fragrance chord, fragrance melody, fragrance tonality.

There are three characteristics of aromatic molecules: smell, aroma, bouquet, each of which carries a different emotional color. Smell is actually aromatic molecules. It can be pleasant and unpleasant, nauseating, rotten, disgusting, beautiful. Aroma is a pleasant smell. The expression "nauseating, unpleasant aroma" is illiterate and incorrect in content. The concept of "bouquet" includes aromas (pleasant smells) that arose in the process of technological operations, enzymatic processes, aging or ripening of a food product. The term "bouquet" is used to describe wines, cheeses, spices, and tea.

The organs of human olfactory perception consist of the receiving organ - the nose, sinuses, and olfactory epithelium. The nasal cavity begins with openings called nostrils and located in the horizontal plane, and ends with openings connecting the nasal cavity with the nasopharynx and located in the vertical plane - choans. The nasal cavity is divided into two parts (left and right) by the nasal septum. An adult has three nasal chambers on each side, one above the other. The entire nasal cavity is lined with a mucous membrane, but the sensory cells are only in the olfactory epithelium. It is clear from Figure 1.3 that the perception of smell requires that aromatic molecules pass through all three chambers in sequence and reach the olfactory epithelium.

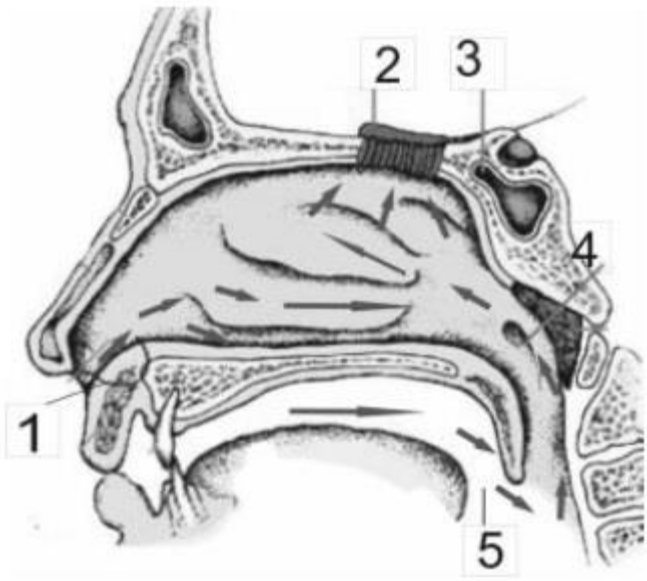



Fig. 1.3. Organs of smell and the scheme of movement of air flows: 1 – nasal turbinates; 2 – olfactory epithelium; 3 – wedge-shaped sinus; 4 – opening of the auditory tube; 5 - a sip

Molecules of aromatic substances entering the nasal cavity with the flow of air dissolve in the mucus covering the olfactory epithelium and interact with receptor proteins contained in the membrane of the cilia of the olfactory neurons. This interaction changes the ionic permeability of the cell membrane and forms an electrical impulse that is transmitted along the axon of the cell to the olfactory nerve and on to the motor neurons of the spinal cord, which causes the muscles of the command to pinch the nose or close the eyes in pleasure.

When studying the specifics of a person's sense of smell, the most difficult question is the study of the mechanism of smell identification: how does a person understand that "this" is the smell of a rose, "this" is the smell of cinnamon. The exact mechanism of aroma recognition by humans is still the object of research by scientists.

The study of the mechanism of smell has shown that a single receptor neuron can recognize many aromatic molecules, each of which activates different receptors. Thus, the number of odor

combinations can be infinitely large.

For many years, scientists from different countries have tried to classify smells. The first attempt to classify smells was made by K. Linnaeus in 1756, who proposed dividing all smells into seven groups.

There are several more classifications:

1) the classification of smells by I. Zwaardemaker (1914) - the division of all smells according to the quality of sensation into nine main classes: ethereal (acetone), aromatic (clove), balsamic (vanilla), ambromuscous (musk), garlic (hydrogen sulfide) ), burnt (benzene), caprylic (cheese), unpleasant (the smell of bugs), nauseating (skatole);

2) classification of smells by Crocker and Henderson - based on the selection of four main smells: aromatic, sour, burnt and caprylic (from the Latin "goat"), and four types of olfactory receptors corresponding to them. Crocker and Henderson proposed to divide any smell into four categories, conditionally measuring their intensity with numbers from 1 to 8. For example, vanillin according to this classification has the number 6021, where the intensity of color is 6, acidic - 0, burnt - 2, caprylic - 1;

3) Henning's classification (1924). According to H. Henning's system, all olfactory sensations are graphically depicted in the form of a prism, the corners of which are marked with six main olfactory sensations: floral, fruity, spicy, resinous and burnt. Henning believed that all odors that could not be directly attributed to one of the six listed classes had to occupy a position in this prism on the edges, on the plane or inside it, depending on how many and with which classes they appeared similarity. This classification is still used by perfumers;

4) Amoor classification. In 1962, Amoor divided all smells into seven "primary" ones: camphorous, musky, floral, minty, ethereal, caustic (pungent), putrid.

A condition in which a person's odor detection threshold is below the minimum value is called anosmia. Anosmia can be complete (absence of smell) and partial, when a number of similar compounds are not perceived. Cases of complete anosmia are very

rare. According to the latest data, about 3% of the population shows anosmia to the smell of isovalerianate (the smell of sweat). The genetic and neurological causes of anosmia are unknown. Painful aggravation of the sense of smell is called hyperosmia.

A person feels smells only during inhalation, because the exhaled air passes only through the lower sinuses and does not come into contact with the olfactory epithelium. With a calm inhalation near the nasal sinuses, the epithelium located at the very top allows only 7-10% of air to pass through, so to enhance the olfactory sensations, it is necessary to take several small, intense breaths and exhale through the nose, as professional tasters do.

It is extremely difficult to verbally describe smells, since each taster has his own personal associative vocabulary. During the work of the tasting commission, it is necessary to use common terms that are clearly understood. The strength of the olfactory sensation depends on the concentration of the smelling substance, but up to a certain point: if the smell is too concentrated, it is perceived by a person as unpleasant, aggressive. So, for example, the concentrated smell of mercaptan emitted by a skunk can make a person gag, the concentrated smell of ammonia leads to a reflex hold of breath. These reactions of the human body are a kind of protection against too aggressive smell. Most aromatic compounds can affect the fibers of the trigeminal nerve, whose nerve endings are chaotically distributed over the entire surface of the olfactory epithelium. This action is manifested in the form of burning, tingling, pain, freshness.

It is known that women perceive and recognize smells better, although there is some differentiation and in this case, women are better at recognizing floral and food aromas, and men - technical and petroleum. This is due to the greater emotional openness of women. On the other hand, women's perception of smells depends on hormonal cycles. The acuity of smell is also affected by the age of a person, which is primarily associated with a decrease in the regeneration of receptor neurons and, as a result, a reduction in short-term memory for smells and an increase in perception and recognition thresholds. Despite a significant loss of olfactory abilities, the acquired experience allows older tasters to remain the

best. It is a common belief that smoking has a negative effect on the ability to smell, although there are many examples where a person who smokes has become an excellent taster. However, studies have proven that a person who smokes loses his sense of smell faster than a non-smoker with age. There are practically no smokers among perfumers.

*Indicators of product quality determined by smell:*

– smell – a feeling that occurs when the olfactory receptors are excited, which is determined qualitatively and quantitatively;

– aroma – a pleasant, harmonious smell characteristic of this food product (ordinary wine, tea, drinks, fruits, spices, etc.);

– "bouquet" – a pleasant smell that develops and is formed under the influence of complex processes that occur during ripening, and fermentation (for example, the "bouquet" of aged wine).

### 1.1.4. Auditory and tactile sensations, their participation in sensory evaluation of food products

Hearing is a person's ability to perceive sound and navigate with the help of a hearing analyzer in the environment. For the taster, hearing is of secondary importance and is used in assessing the quality of carbonated drinks, sparkling wines, lamb products, and snack products.

A person can hear sound in the range from 16 Hz to 20 kHz. Sound waves in the range of 300-4000 Hz correspond to the human voice. The range of frequencies that a person can hear is called the auditory or sound range; higher frequencies are called ultrasound, and lower frequencies are called infrasound. With age, the perception of the frequency range of 16-20 kHz can change significantly - high frequencies are perceived more and more poorly.

Hearing depends on the outer, middle and inner ear, which perceives sound vibrations; auditory nerve, which transmits signals received from the ear; certain parts of the brain (auditory centers), in which the impulses transmitted by the auditory nerves cause awareness of the output sound signals.

Touch gives the taster a lot of information about the quality characteristics of the food product being evaluated. Without touch, it

is impossible to fully assess the quality of a food product, as the result of the tasting will not be informative enough. Touch is the ability to perceive the effects of environmental factors with the help of receptors on the skin surface and the mucous membrane of the oral cavity. The touch process is based on the irritation of various types of receptors: mechanoreceptors that perceive touch, pressure, and stretching; thermoreceptors that perceive heat and cold; pain receptors. After perception, the information received by the central nervous system is transformed. The tactile sensation can be very diverse, because it arises as a result of the perception of a complex stimulus.

In the organoleptic analysis, touch allows you to determine: in the oral cavity – juiciness, consistency, structure, density, temperature of the product, etc.; by touch - elasticity, fragility, friability, etc.

Fig. 1.4 shows the structure of human skin.

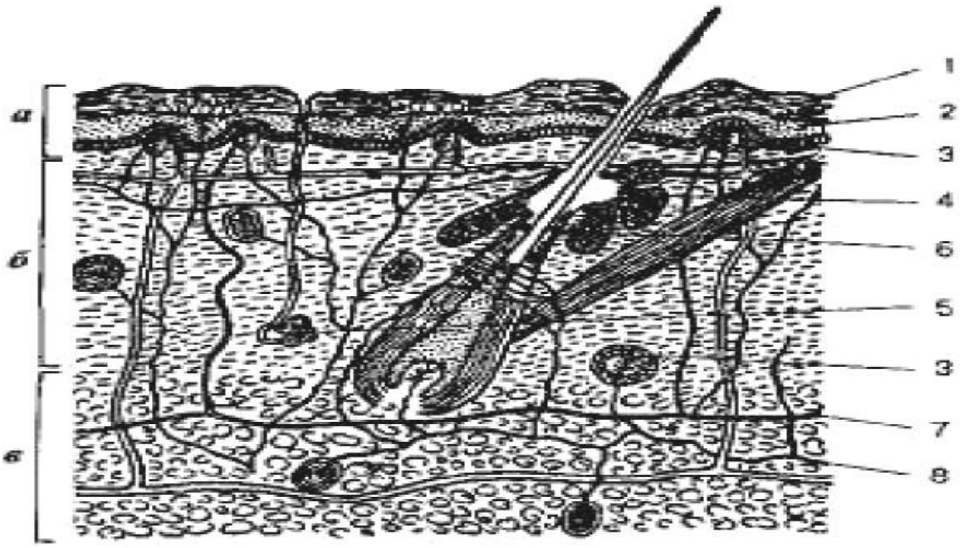



Fig. 1.4. Structure of human skin:
a – epidermis (epidermis); b – skin itself; c – subcutaneous adipose tissue; 1 – stratum corneum of the epidermis; 2 – a layer of living cells of the epidermis; 3 – skin receptors; 4 – sebaceous glands; 5 – sweat glands; 6 – hair root; 7 – blood vessel; 8 – nerve

A person's tactile sensitivity depends on a huge number of external and internal factors. It decreases from mechanical and

chemical damage to the body, with a sharp change and drop in the temperature of the air and objects, which is noticeable. The optimal temperature at which high tactile sensitivity is observed is between 16 and 20°C. At low temperature, skin sensitivity decreases. Tactile sensitivity depends on the nature of the tactile surface: the pads of the fingers and the tip of the tongue are the most sensitive to pressure. Intermittent and point positive relief feels better than continuous.

Tactile sensations will be weak, imprecise and vague if the skin and the object are in stationary contact. Such touch is called passive. Tactile sensitivity increases sharply and becomes clearer if you slide the tangible surface of the skin or make small reciprocating movements on the surface of the object. Such touch is called active.

Heat and cold receptors located in the human skin not only serve as sensors for the conscious feeling of temperature, but also participate in the regulation of body temperature. The activity of these thermoreceptors is beyond human awareness at the physiological level. There are more cold receptors than heat receptors: 1-5 points of cold and only 0.4 points of heat per 1 cm2 of the skin of the hand. Therefore, the skin is more sensitive to cold than to heat. A person can feel heat and cold with a small temperature difference - up to 0.1ºC.

The sensation of heat and cold occurs faster, the greater the temperature difference, and depends on the surface area of the skin touching the object: the larger the surface of the skin, the faster and with a smaller temperature difference, heat and cold are felt. It is more difficult, for example, to determine the temperature with the tips of the fingers, it is easier to apply the entire palm to the object.

Tactile sensations depend on the duration of touching. The perception of tactile sensations is influenced by fatigue, bad mood, concentration and personal experience of the taster. Tactile sensitivity is characterized by three interrelated threshold values: intensity threshold (absolute and relative), spatial and temporal thresholds of tactile discrimination. Of all types of skin sensitivity, tactile sensitivity has the most acute and lowest thresholds.

Finger pads and the tip of the tongue are most sensitive to

pressure. Oral receptors can also sense pressure, temperature, and pain.

The ability to touch depends on the taster's individual abilities and the environment.

Product quality indicators, determined by a tactile method (deep touch):

– consistency – texture characteristic reflecting the set of rheological properties of food products;

- density - property of the resistance of the product that occurs during pressure;

- elasticity - the ability of the product to return to its original shape after the pressure is stopped, which does not exceed a critical value (elasticity limits);

- elasticity - a characteristic of the texture, determined by the speed and degree of restoration of the initial dimensions of the product after the termination of the deforming effect;

– stickiness – the ability of the texture due to the effort required to overcome the force of gravity between the surface of the product and the tongue, palate, teeth or hands;

- plasticity - the property of the texture not to be destroyed during the process and after the deformation effect is stopped;

- fragility - the property of the texture to be destroyed by small sharp deformations.

### 1.1.5. Taste sensations, their perception and definition

There is still no generally accepted theory of taste. Back in 1752, M. U. Lomonosov proposed one of the first classifications of taste. He wrote: "The main more distinct taste sensations are as follows: 1) the taste is sour, like vinegar; 2) caustic, as in wine alcohol; 3) sweet as in honey; 4) bitter, as in tar; 5) salty, as in salt; 6) sharp, as in wild radish; 7) acidic, as in unripe fruits. Which of them are simple, which are complex, is unexplainable until its nature is known."

Attempts to reveal the physicochemical mechanisms of taste were made by the German physiologist D. Rehnquist in 1919 and academician P. P. Lazarev in 1922. The theories by Lazarev and

Rehnquist do not fully explain all the features of taste sensations. Their main merit lies in the fact that the researchers tried to identify the physical and chemical processes that underlie the development of the excitation of taste receptors; the fundamental drawback is that they were limited to the study of only these processes, without touching the interpretation of various taste sensations.

Despite numerous studies, the mechanism of the emergence of taste sensations is still not clear, there are many questions to which there are still no exact answers. Why can substances of different nature cause the same taste? For example, fructose and aspartame, stevia and sucrose, having different molecular formulas, give a sweet taste. Why do substances of similar nature or even optical isomers taste different? A solution of table salt in a very small concentration has a sweet taste; saccharin in high concentration has a bitter taste; some amino acids in the L-form have a sweet taste, while the D-form has a bitter taste.

The entire inner surface of the oral cavity, the soft palate, and pharynx are covered with taste buds to varying degrees of localization. The largest number of them is on the tongue. The surface of the human tongue is covered with a mucous membrane, on which papillae of four different shapes are chaotically located: thread-like, grooved, leaf-like, and mushroom-like. These four types of papillae are distributed on the surface of the tongue in different ways: mushroom-shaped papillae are scattered over the entire surface, grooved papillae are concentrated near the root of the tongue, leaf-shaped papillae are located along the edges of the tongue, filiform papillae are located in the center of the tongue and do not have taste buds, so the center of the tongue is rather amorphous. Mushroom-shaped papillae occupy almost the entire surface of the front 2/3 of the tongue, grooved papillae are located behind them, and even further, on the lateral edges of the tongue, there are leaf-shaped papillae near its root (Fig. 1.5).

The taste substance, dissolving in saliva, enters the sensory cell through the taste pore, from where the signal of chemical irritation is transmitted to the human brain by means of nerve impulses.

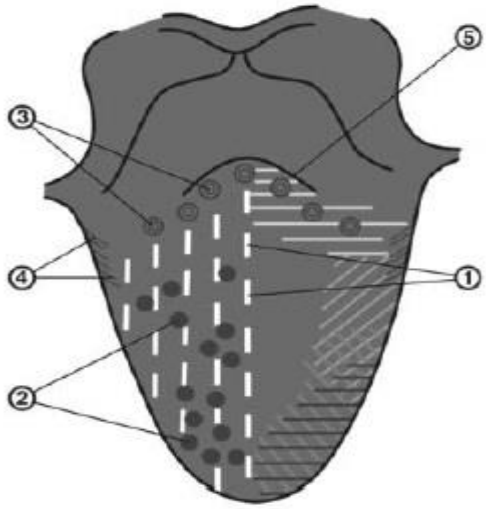



Fig. 1.5. "Language Map":

1 – filiform papillae; 2 – mushroom-shaped papillae; 3 – grooved papillae; 4 – leaf-shaped papillae; 5 – border furrow; on the left side of the tongue, the zones of perception of taste stimuli are marked with multi-colored lines (horizontal light lines show the zone of perception of bitter, horizontal blue lines - sweet, oblique dark - salty, oblique light - sour).

The life span of sensory cells is short - 10-14 days, then they are replaced by a new cell formed from the basal cell. The interaction of the molecules of the taste cell leads to its depolarization, which is associated with a change in the permeability of the areas of the membrane on which the taste receptors are located.

It is traditionally believed that a person is able to recognize four main tastes and several secondary ones. The main tastes include – bitter, sweet, sour, salty; secondary ones are alkaline, metallic and umami. Bitter taste is mostly given by alkaloids, sweet – by sugar (fructose, glucose, sucrose), sour – by various acids (citric, tartaric, lactic acid), salty – only by sodium chloride (table salt). Typical standards of various flavors are considered to be: sucrose solution – sweet, sodium chloride solution – salty, caffeine solution – bitter, citric acid solution – sour.

There are many shades of the same taste, even if the flavor

substances are taken in the same concentration. For example, the acid profile of different acids is different: in malic acid it is sharp, rough; in milk - soft, long-lasting, enveloping; in lemon - aggressive and short. Tasters also distinguish between bitterness profiles - quinine, hop, pure, etc. The examples show that even one taste consists of several flavors.

An example of an alkaline taste can be a solution of baking soda ("soapy" taste), a metallic taste is, rather, a physical sensation on the tongue associated with iron, rust, etc. (tasters often use the concept of "minerality" in white wine; according to the authors, "minerality" has a slightly metallic shade in the taste). Umami is a full enveloping taste caused by complex nucleotides, for example, monosodium glutamate. The word "umami" translated from Japanese means something between "great taste" and "spiciness". Substances are often used as flavor enhancers.

When tasting quince, tea, and red wines, they often talk about the concept of "tartness" as a source of astringent taste. In fact, the feeling of an astringent taste in the mouth occurs because of damage to the mucous membrane due to protein coagulation by the substances contained in these products. With these injuries, the endings of sensitive nerves that respond to touch are excited.

All other tastes - apple, oyster, pineapple, smoked products - are olfactory sensations.

The speed of sensations is not the same, because there is a differentiation of the tongue according to the areas of perception of different tastes: yes, the tip of the tongue is responsible for sweet taste, the root of the tongue - for bitter, the side surface of the tongue - for salty and sour. It is in connection with this arrangement of taste zones that tasters are recommended to try the sample on the "whole tongue", wetting its entire surface with the sample being tasted.

Certain taste impressions also occur under the action of thermal stimulation. For example, mild heating of the tip of the tongue to 38–35ºC can cause a sensation of sweet taste.

The concept of "aftertaste" can also be attributed to the terms of taste. "Aftertaste - an olfactory or gustatory sensation that appears after swallowing or removing a product from the oral cavity, which

differs from those sensations that were perceived when the product was in the oral cavity." The aftertaste can be pleasant or unpleasant; long, medium and short. The duration of the aftertaste is measured in cuadals, one cuadal equals 1 second.

The threshold of detection and the threshold of recognition are different for each taste and chemical substance and depend on the degree of receptivity and sensory abilities of the taster. Their definitions are as follows:

*detection threshold* - is the minimum amount of stimulus necessary for the sensation to occur. The stimulus can be identified*;*

*recognition threshold* - the minimum value of the stimulus, which allows qualitative description of the nature of sensation.

Saliva is a decisive factor in determining the threshold of perception and recognition. Human saliva is a complex combination of inorganic phosphates, carbonates, sulfates, chlorides and organic food enzymes (amylase), proteins, etc. Washing the tongue with distilled water reduces the sensitivity to salty taste. Also, perception is influenced by the chemical nature of the stimulus and the concentration of the taste substance, the temperature of the taste sample, the area of influence of the stimulus, the environment, the previous tasting of the food, the age of the taster, and the order of testing.

Salty food seems more salty if it is heated or cooled, sweet - if it is cooled.

Since different regions of the human tongue vary in their sensitivity to basic tastes, the use of flavor solutions of small concentrations increases the taster's degree of attentiveness to his/her sensations in a specific part of the tongue, the taste buds are "tuned", and the taster's sensitivity increases.

Rare pathologies of the sense of taste include ageusia - the complete absence of a sense of taste in a person and hypergeusia - increased taste sensitivity. The most common pathology is dysgeusia, a disorder of taste perception, when a substance with a pleasant taste seems tasteless.

Product quality indicators determined in the oral cavity:

– *juiciness* – the impression produced by the juices of the

product during chewing (for example, the product is juicy, slightly juicy, slightly dry, dry);

- *homogeneity* - the feeling of touch produced by the size of the product particles (homogeneity of chocolate mass, candy fillings);

– *consistency* – a touch that perceives the density, stickiness of the product, pressure force; it is felt when the product is distributed on the tongue (consistency is liquid, syrupy, thick, dense);

- *fibrousness* - an impression caused by fibers that provide resistance during chewing of the product, which can be felt qualitatively and quantitatively (for example, meat with thin fibers);

- *fragility* - the property of a solid product to crumble during biting and chewing, due to a weak degree of adhesion between particles;

– *tenderness* – a conventional term, means the resistance that the product exerts during chewing (for example, a soft apple, a crispy cucumber, tender meat);

- *astringency* - a feeling of touch, caused by the fact that the inner surface of the oral cavity contracts and at the same time dryness appears in the mouth;

- *taste* - a sensation that occurs when receptors are excited and is determined both qualitatively (sweet, salty, sour, bitter) and quantitatively (taste intensity);

– *flavor or deliciousness* – a complex sensation of taste, smell and touch when distributing the product in the oral cavity, is determined qualitatively and quantitatively;

- *texture* - the term refers to the macrostructure of a food product, which is characterized by a complex of visual, auditory and tactile sensations that occur during chewing of the product. The texture can be hard, elastic, fibrous, porous, layered, soft, hard, tender, fragile, sticky, etc.

The sense of smell plays an important role in the perception of taste and enjoyment of food.

### 1.1.6. Factors affecting the results of sensory analysis

The objectivity of the taster's assessment is influenced not only by innate natural sensory abilities, but also by his sensory memory, reproducibility, conformity, and discipline. In addition, the taster's objectivity is influenced by age, external and physiological factors.

**External factors**

*Sample feeding order and temperature.* Samples for tasting should be presented in order of increasing intensity of taste and aroma. The temperature of the samples should be close to the temperature of use, unless it is determined by an additional regulatory document.

*Lighting and room for organoleptic analysis.* The best lighting for organoleptic analysis is diffused daylight. If artificial lighting is used, then the optimal light source is a daylight lamp with an additional local lamp above the place of the taster. The walls of the tasting room should be painted in a light color, the optimal location of the windows is on the north side, the room should be equipped with ventilation and air conditioning to regulate the air temperature. The interior of the room should contribute to maximum concentration of the taster's attention.

**Physiological factors**

Physiological factors affecting the objectivity of the tasters' assessment include synesthesia, sensitization, taste and smell fatigue of the taster, as well as adaptation.

*Synesthesia* (Greek: "simultaneous feeling, common feeling") is a phenomenon of perception, when one sense organ is irritated next to its specific sensations, sensations corresponding to another sense organ arise. For example, an experienced taster of the aroma of vodka can determine its sweetness; when assembling cognac spirits, tasters are guided only by the sense of smell, although the selected cognac spirits primarily form the taste of cognac. The color of the product indirectly affects its taste perception. For example, a green drink is perceived as more acidic, a cloudy yellow drink is denser and sweeter, a colorless drink is good for quenching thirst, etc. Odors can affect the perception of taste. For example, drinks with the smell of apricot or peach are perceived as sweeter than drinks with the

smell of lemon and orange, because the taster subconsciously associates them with the fruits of the same name.

*Sensitization* is an increase in sensory sensitivity to stimuli. If the olfactory and taste receptors are repeatedly exposed to weak stimuli at certain time intervals, there is a persistent increase in the sensitivity of these receptors. Using this phenomenon, tasters can make "adjustments" of their olfactory and taste analyzers. The effect of sensitization can last for quite a long time - up to 20 days.

*Adaptation* is a decrease in sensory sensitivity during prolonged exposure to a taste or smell stimulus. An example of adaptation can be a decrease in olfactory sensitivity during a person's stay in a smoky room or hall of a perfume store. When entering a room with a pungent smell, a person immediately and very sharply smells the smoke or a mixture of perfume aromas. However, after a few minutes, the brightness of smell perception dulls, the person adapts to the smell.

To avoid the occurrence of adaptation and sensory fatigue, it is necessary to limit the number of samples offered for tasting. The number of samples depends on the experience of the tasters, the properties of the product being tasted (for example, when tasting smoked meats, hot sauces, the number of samples cannot exceed 2-3 for one tasting). Products for tasting can be formed into groups of 2-3 samples, between the tests of which the tasting commission is offered to restore sensory sensitivity during a break. Restoration of sensory sensitivity between samples is mandatory. Recovery is carried out by rinsing the mouth with unsweetened tea, non-carbonated drinking water, chewing crumbly white unleavened bread.

In addition, sensory fatigue can be increased by malaise and decreased concentration of the taster, conditions and mode of tasting.

The following concepts are used to quantitatively characterize the sensory abilities of tasters:

- *detection threshold* - the minimum value of the stimulus that causes sensation;

– *the recognition (identification) threshold* – the minimum value of the stimulus that allows qualitatively describing (identifying) the nature of the feeling;

– *differential threshold* – minimal change in the amount of the identified stimulus, which causes a change in the intensity of its sensation;

- *individual reproducibility of assessments* - the ability of the same subject to obtain identical results during repeated analysis of the same product, which is carried out under the same conditions, but at different times;

– *sensory memory* – the ability to remember and recognize various impulses and sensory impressions;

- *sensory minimum* - minimum sensitivity and ability of the senses to perceive impressions. This condition is especially important for research and control purposes.

**Questions for discussion and self-examination**

1. What does the science of "sensory analysis" study?
2. When was the science of "sensory analysis" formed?
3. Name the main human sensory analyzers.
4. What is the duration of sensory reactions for individual human senses?
5. What is the difference between the concepts of "sensory analysis" and "organoleptic analysis"?
6. What factors affect the quality of food products?
7. What group indicators does the nomenclature of product quality indicators consist of?
8. List the quality indicators that are determined by sight.
9. List the quality indicators determined by a tactile method.
10. List the quality indicators that are determined by smell.
11. List the quality indicators determined in the oral cavity.
12. Submit the classification of tasters and tastings according to the International Standard for Sensory Analysis.
13. What factors affect the taster's professionalism? Describe them.
14. How are the requirements for the tasting room and for the

technique of conducting tasting analysis formulated in the International Standard?

15. Define the concept of taste.

16. State the structure of the organs of taste perception.

17. To characterize the process of perception of taste sensations.

18. Describe the theories of taste perception.

19. Characteristics of the main types of tastes and their standards.

20. The essence of the processes of adaptation, sensitization and taste fatigue.

21. Define the concepts of "smell", "aroma", "bouquet", "purity of smell".

22. Explain the structure of the organs of perception of smells.

23. Describe the process of smell perception.

24. Give existing theories of smell perception, development of theories.

25. Characteristics of the classification of smells by Eimur, Zwaardemaker, Crocker, Henderson. Odor standards.

26. Define the intensity of the smell.

27. Characterize the dependence of odors on the chemical composition of food products.

28. Define the concept of adaptation

29. How does the differential threshold differ from the recognition threshold?

30. Name the physiological factors affecting the objectivity of tasters' assessment.

## 1.2.1 Classification and general characteristics of organoleptic analysis methods

According to the generally accepted international classification, all methods of organoleptic analysis are divided into analytical and consumer.

The fig. 1.6 presents the international classification of organoleptic analysis methods.

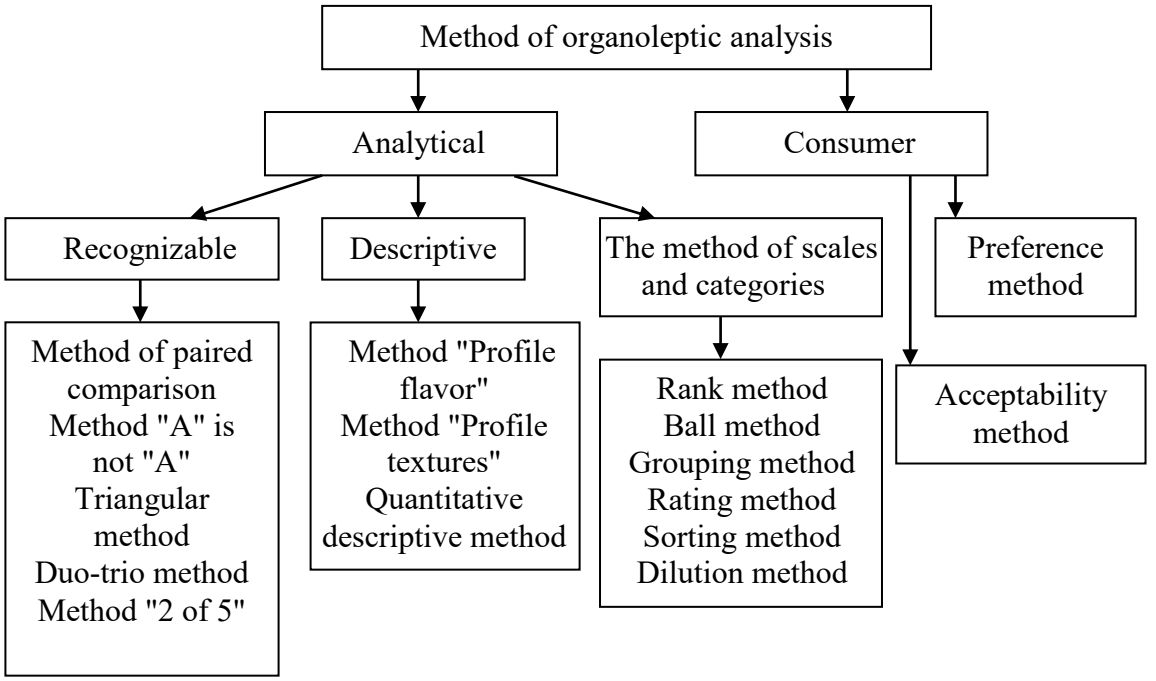



Fig. 1.6. International classification of methods of organoleptic analysis

Analytical methods include three groups of methods: recognitiory, descriptive, and methods of scales and categories. Members of the tasting commissions, who carry out organoleptic evaluation of food products by these methods, must have good sensory sensitivity to tastes, smells, textures; they must be properly selected and trained. As a rule, the obtained evaluation results are sufficiently reliable, the number of errors is insignificant. Consumer

methods include methods, during the use of which organoleptic evaluation is carried out by buyers or consumers of food products, who are well aware of their sensory characteristics and features and are usually selected in the form of likes and dislikes.

### 1.2.2 Methods of consumer assessment

Consumer evaluation is simple, accessible and often pursues one goal: to determine whether a product is liked or not. The evaluation committee should consist of at least 20 people, preferably 30-40.

**The methods of consumer** evaluation aim to check the reaction of consumers in connection with a change in the formulation and technological regimes. Together with the new product, it is necessary to evaluate the existing product made in the traditional way. Since consumers are very different, it is recommended to follow these conditions.

For the consumer assessment, you should attract a wide range of consumers, preferably from the region where the product will be sold. At the same time, you should be guided by the opinion of the category of people for whom this product is intended. For example, to evaluate the quality of baby food products, involve children of the appropriate age and their parents. To evaluate new dietary products, invite people who follow a special diet. Confectionery containing sucrose substitutes will be better appreciated by people suffering from diabetes. Gluten-free bread can be highly appreciated by people following a suitable diet. However, it will be unacceptable to those for whom it is not intended.

The results of consumer evaluation will be more reliable if a permanent team of evaluators who have previously been familiarized with the rules of conducting tastings and the applied methods is involved in the tasting of products of one product group. The training of the group is more important than the method used and the type of scale.

The experience of specialists of enterprises manufacturing food products is also of great importance when assessing the quality of products of a new assortment. Therefore, their participation is not

excluded, but the formation of teams of evaluators should be carried out separately: either from non-specialist consumers, or from specialists who have experience in sensory testing of the same product. Expert tasters can use more complex scales and are able to provide valuable information that will allow a decision to be made regarding a new range of products.

Experience has shown that the order of submission of samples affects the evaluation results. The first product can significantly change the evaluation of the product introduced after it. In a consumer test, the order of submission of samples should ensure an equal opportunity to choose any of the test samples. When analyzing the data obtained during such tests, the average quantitative indicator of the sample presented first should be taken into account in comparison with the quantitative indicator of the sample presented second.

Sample size is also a crucial factor. Often, when evaluating the taste of a product, people are given "a little taste", but this amount may not be enough to get a true impression. The first impression one has of a product after one or two sips, bites or spoonfuls can be very different from the final evaluation made after consuming a full portion. This is true for many foods, especially savory ones with added spices and seasonings.

When conducting a consumer evaluation, tasters can use the simplest method of a single experience, equating the evaluated sample by memory, or apply a more sophisticated evaluation method based on a control sample, based on the comparison of a food or flavor product with a control sample.

More often in consumer evaluation, a system of advantages and acceptability using a scale of desirability is used, which allows to single out not only the best sample, but also the degree of its desirability depending on any factor: changes in the formulation, conditions and terms of storage, technological mode, etc. The percentage of undesiredness is calculated as the ratio of undesired grades for each sample to the total number of grades.

**The preference method** is based on determining the degree of preference of one or more samples selected from a number presented

for evaluation, using hedonic scales (from the Greek hedon - pleasure). The hedonic scale reflects the degree of acceptability and preference within the "like-dislike" range.

A group of consumer tasters receives clarification from the organizer on how to conduct the evaluation. Any influence on the group can lead to distortion of the results.

When developing preference methods, great attention is paid to the maximum simplification of questionnaires offered to tasters. The best results are obtained when consumers are presented with simple hedonic scales, in which they are asked to make appropriate marks depending on their opinions about the evaluated samples. There are different types of scales. The simplest of them are the verbal Hedonic scale and the Hedonic scale of persons.

The Verbal Hedonic Scale has nine levels of desirability. The answer is to put a cross against the word corresponding on the scale of the impression left by the product. Along with the assessment of the degree of desirability of the product, statistical processing of the data can be carried out through the analysis of discrepancies. At the same time, the highest level of desirability is assigned 9 points, and accordingly, "very undesirable" - 1 point.

The fig. 1.7 shows the hedonic scales of individuals according to K. Pompei. The lower scale is designed specifically for obtaining responses from children over five years of age. The hedonic scales of persons have the advantage that they allow to avoid misunderstandings in the perception of the terms slightly, moderately, strongly, extremely, which should be used in the verbal hedonic scale. The answer is to indicate which image in the figure best matches the taster's opinion of the quality of the product. For static processing of the results, it is possible to perform an analysis of differences by assigning the answers (pictures) the corresponding points.

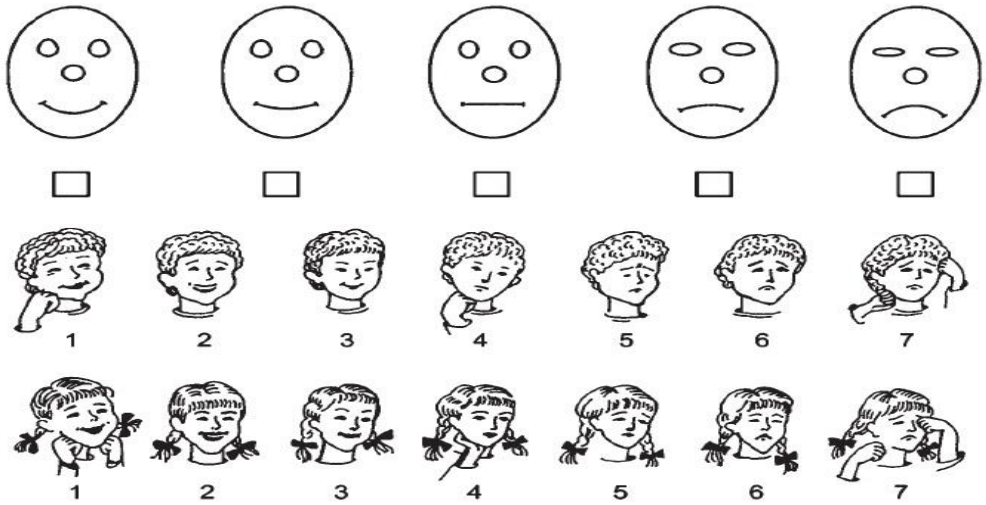



Fig. 1.7. Hedonic face scales for adult tasters (top row) and children (according to K. Pompei)

One of the foreign developments is a nine-level scale located between two limits: "I will use (or consume or buy) this product whenever I can" and "I will use (or consume or buy) this product only , if they make me do it." The scale is intended to obtain from consumers an answer to the question of whether they will consume this product.

Consumer desirability is an important quality assessment criterion, however, the consumer's attitude to the product depends on many factors, both subjective (habit, prejudice, etc.) and objective (economic, advertising).

Various verbal and graphic scales are used to assess acceptability. The hedonic scale reflects the degree of acceptability and preference within the "like - dislike" range. When working with the use of hedonic scales, great attention is paid to the maximum simplification of questions offered to tasters-consumers. The best results are obtained when consumers are offered simple hedonic scales on which to give their marks.

Among the existing types of scales, the simplest are the verbal hedonic scale and the hedonic scale of persons.

An example of a typical tasting sheet for assessing acceptability using a verbal hedonic scale (desirability scale)

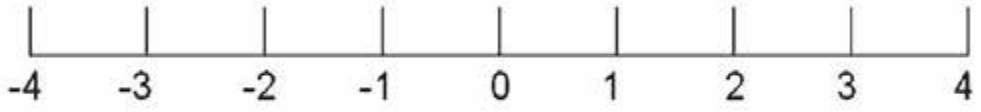
| Acceptance test | |
|---|---|
| Product name | |
| Full Name | |
| Date | |
| WARNING!<br>Please rinse your mouth with water before tasting.<br>Mark in the left column with any symbol the level of acceptance that corresponds to the presented sample<br><br>Sample number _____ | |
| | Highly desirable |
| | Very desirable |
| | Desirable |
| | Undesirable |
| | Neutral |
| | Slightly undesirable |
| | Less desirable |
| | Very undesirable |
| | Extremely undesirable |

For a hedonic assessment, you can also use a scale with schematic images of the faces of adults and children, on which evaluators mark their opinion. Some researchers believe that a scale with pictures of cartoon characters or people is more representative.

It is better to use a verbal scale for working with children. The number of points in the scale designed for working with children changes proportionally to their age from 3-5 to 9. It should be noted that the competitiveness of the product does not affect children, and their evaluations are completely based on effective impressions.

Although environmental conditions affect the hedonic evaluation, the order of product acceptability does not change. The hedonic scale is applicable across regions and is somewhat independent of group size.

If the neutral desirability level of the indicator is adopted as "0", the verbal hedonic scale can be converted into a graphic one.




An example of a graphical hedonic scale

Since consumers tend to avoid harsh judgments and extreme evaluations, establishing a product category using "neutral" in response scales somewhat reduces the effectiveness of evaluations. However, for some consumers, a neutral reaction is the only reliable one for the sample being tested.

### 1.2.3 Analytical methods of organoleptic analysis

*General characteristics*

Analytical methods of organoleptic analysis are based on qualitative and quantitative assessment of quality indicators and allow establishing a correlation between individual characteristics. Analytical methods are divided into recognitory, descriptive and methods of scales and categories.

Diagnostic methods are used when it is necessary to find out whether there is a difference between the products being evaluated. Some methods from this group also allow quantitative assessment of the existing difference. Recognitory methods are also widely used when testing the sensory abilities of tasters.

With the help of descriptive methods, it is possible to summarize the parameters that determine the properties of the product, to consider the intensity of these properties, and in some cases, the order of manifestation of individual properties of the product components, that is, to build profiles of properties (for example, profiles of taste, smell, consistency of the product). The use of descriptive methods requires the involvement of well-trained groups of specialists. Descriptive methods are the most important in the methodology of organoleptic analysis. Only when there is a

detailed description of the products and the described properties, marked by the intensity of manifestation, can one detect real differences or product drift, that is, a barely noticeable, gradual shift in characteristics within a certain period of time.

Product change can occur very slowly, almost imperceptibly due to the gradual change in the composition and properties of raw materials, the introduction of food additives.

Abroad, the problem of food drift is a matter of particular concern. Product drift can occur, for example, in such a situation. A small modification of the recipe or production modes did not significantly change the quality of the product compared to the initial (first) product. Subsequent changes in technological parameters also did not give noticeable differences in the quality of the new product (third) compared to the previous (second), however, the third product may differ in quality from the first (initial) and, of course, in the direction of deterioration.

In order to avoid product drift, its sensory properties and the intensity of their manifestation should be studied in detail. Such an organoleptic analysis requires the use of descriptive methods, which are carried out by a specially trained group of specialists who develop descriptive terminology for the sensory characteristics of the product and normalize them by intensity.

The organoleptic indicators of products are immeasurable, the values of which cannot be expressed in physical size scales. The description of taste, smell, consistency and other sensory features ends with a qualitative description. To translate quality into quantity, expert evaluation uses dimensionless scales: usually in points, less often in fractions of a unit or percentages.

The scoring scale is an ordered collection of numbers and qualitative characteristics that are given in accordance with the evaluated objects according to a defined feature.

**Recognition methods (difference methods)**

This group of analytical methods includes research methods that are used to determine whether there is a sensory difference between two products:

– method of paired comparison;

– method "A" not "A";
– triangular method;
– "Duo-trio" method;
– method "2 out of 5".

**Method of paired comparison** regulated by the International Standard ISO 5495:2005 Sensory analysis – Methodology – Paired comparison test and its domestic analogue DSTU ISO 5495:2005 Sensory research. Methodology. Method of paired comparison.

The paired comparison method is convenient to use to find out the effect of any factor on product quality: changes in the recipe, production or storage technology, use of a new type of packaging, etc. Tasters are offered a set of paired samples. The answer may consist in recognizing the samples as the same or different from each other. Only one property can be evaluated at a time (for example, the degree of aroma expression, or consistency, or another property). If different properties are to be compared, the test should be repeated as many times as the product properties are evaluated. The method of paired comparison can also be used in cases where it is necessary to find out which of two products is better.

The above-mentioned standard describes the method of detecting discrepancies in the sensory characteristics of two products. An important condition for the application of this method is to first determine whether the method is one-sided (when one direction is of particular interest) or two-sided (when both directions are equally interesting).

The method of paired comparison can be used for the following purpose:

– to determine directional differences: to determine the direction of differences between two evaluated samples by a defined characteristic (for example, less or more sweet);

– to determine preference: to establish preference between two evaluated samples (e.g. in consumer studies);

– for training experts: to select, train and check the work of experts.

According to the methodology described in the standard, paired samples are presented simultaneously or sequentially. Pairs

are made up of samples with small differences. The order of presentation must be counterbalanced so that combinations AB and BA appear the same number of times and are randomly distributed among subjects. You can offer several pairs in a row (a series of pairs) provided there is no or a minimal level of organoleptic fatigue.

Depending on the purpose of the method, testers may be asked the following questions:

– to determine directional differences: which of these two samples is ... ? (sweeter, saltier, etc.);

– to determine preference: which of these two samples do you prefer?

– for the training of testers: which of these two samples is larger ... ?

The test manager must choose one of the following options:

– according to the "forced-choice" method, to force the subjects to indicate which trial they considered more intense or better compared to the others, even if they claimed that they did not feel the difference;

– allow the answer: "there are no differences", "there are no advantages".

The standard also provides detailed information on the display and analysis of results, sample answer forms, as well as a practical example of use.

An example of a tasting sheet for the method of paired comparisons

<table>
<tr><td colspan="4">Date:_____<br>Full Name _____<br>Object for testing _____<br>Test criterion _____</td></tr>
<tr><td colspan="4">Which of the two samples is more_____?</td></tr>
<tr><td colspan="2">Tested pairs</td><td colspan="2" rowspan="2">More_____<br>sample</td></tr>
<tr><td>…..</td><td>…..</td></tr>
<tr><td>…..</td><td>…..</td><td>……</td><td>……</td></tr>
<tr><td colspan="4">Comment:</td></tr>
</table>

**Method "A not A"** (method of single stimuli).

This method is the prerogative of the International Standard ISO 8588:1987 (now ISO 8588:2017) Sensory analysis – Methodology – "A not A" test and its national analogue DSTU ISO 8588:2005 Sensory analysis. Methodology. Evaluation by the "A not A" method. These standards describe the method used in organoleptic analysis for:

– divergence tests, especially for evaluating samples that have different appearances (preventing strictly identical replicates) or those that have different aftertastes (making direct comparison difficult);

– recognition tests, especially to determine whether a subject or group of subjects can identify a novel stimulus compared to a known stimulus (eg, recognizing the sweet taste of a novel sweetener);

– perception tests - to determine the expert's sensitivity to a specific stimulus.

An example of a tasting sheet for the "A not A" method

<table>
<tr><td colspan="3">Object for testing</td></tr>
<tr><td colspan="3">Date:_____<br>Full Name_____</td></tr>
<tr><td colspan="3">Taste the presented samples and indicate your opinion in the table</td></tr>
<tr><td rowspan="2">Sample code</td><td colspan="2">Feeling</td></tr>
<tr><td>A</td><td>Not A</td></tr>
<tr><td>…..<br>…..<br>…..<br>…..</td><td>……</td><td>……</td></tr>
<tr><td colspan="3">Comment _____<br>_____</td></tr>
</table>

In its classic form, the A not A method is one in which the subject, after learning to recognize an A pattern, is presented with a series of coded patterns that may be either A or not-A. The tester is asked to determine which sample is sample "A".

This method is particularly effective when it is not possible to obtain strictly selected replicate samples. The recommended number of testers is 20 or 30.

**Triangular method (method of triangle)** legalized in the international standard now ISO 4120:2004 Sensory analysis – Methodology – Triangular test and its national analogue DSTU ISO 4120:2004 Sensory analysis. Methodology. Three-way test method.

In the named International Standard, methods are considered that allow to identify differences in the perception of two products using the triangle method (or triple comparison - in the Ukrainian version of the standard). This method is used to detect small discrepancies between product samples. Differences may apply to all characteristics of the samples or to a single characteristic. The method can be used to select and train testers and to monitor their performance.

The method is especially convenient in cases:

– if the number of testers, whose services can be turned to, is not very large;

– if there is no problem of organoleptic fatigue.

The minimum number of examiners depends on the purpose of the study and the accepted level of significance of the results: for a significance level of 5.1%, the minimum number of examiners is 5; 0.1% – 7 people.

When using the triangular (three-way) method, three samples are compared, two of which are identical. Samples are coded and completed in the form of blocks, for example, according to the following scheme: BAB, AAB, ABA, ABB, BAA, BBA, BAB. Testers need to determine which of the three samples is different.

The Appendices to the specified national standard provide information on a possible extension of the three-way method, a sample questionnaire to be filled out during the implementation of

simple and extended methods, and an example of the practical application of a simple three-way study ("forced choice" option).

Example of a tasting sheet for the triangle method

<table>
<tr><td colspan="3">Object for testing</td></tr>
<tr><td colspan="3">Date:_____<br>Full Name_____</td></tr>
<tr><td colspan="3">Rate the three samples in the order specified by the organizers. Indicate (circle) the sample that is different from the other two. The answer option "no difference" is not allowed</td></tr>
<tr><td colspan="3">Sample codes</td></tr>
<tr><td>…..</td><td>……</td><td>……</td></tr>
<tr><td colspan="3">Describe what makes the sample different?_____<br>_____<br>_____</td></tr>
</table>

**Duo-trio method.** The use of this recognition method is due to the effect of the international standard ISO 10399:2017 Sensory analysis – Methodology – Duo-trio test and the national analogue of DSTU ISO 10399:2006 Sensory analysis. Methodology. Testing by the "Duo-trio" method.

These standards describe a method for determining significant differences between two samples. These differences can be related to one organoleptic characteristic or to a whole set of such characteristics.

This test is not used to determine preferences, nor to evaluate the nature or intensity of differences perceived during testing. There are two forms of this method:

– with a variable control sample;

– with a permanent control sample.

The variable control sample technique is used as a tool to control the quality of products by a well-trained tasting panel when the control samples are well known to the testers.

A sufficient number of samples is prepared depending on the number of members of the tasting committee. All samples must be prepared in the same way (same cooking temperature, dishes, amount of product, etc.).

The recommended number of testers is 20 or more.

An example of a tasting sheet for the "Duo-trio" method

| | | |
|---|---|---|
| Object for testing | | |
| Date:_____<br>Full Name_____ | | |
| The sample on the left is the control sample. From the other two samples, determine the sample identical to the control | | |
| Sample codes | | |
| ….. | …… | …… |
| Describe what makes the sample different?_____<br>_____<br>_____ | | |

The container in which the samples are served must be coded, usually a number of three arbitrary digits. Then series of four blocks of samples are formed in the following combinations: AkAB, AkBA, BkAB, BkBA. In the first two blocks in the series, the control sample is sample A, and in the next two blocks, sample B. The prepared sample blocks are distributed among the testers in random order, and simultaneously or sequentially. Testers are asked to choose a sample that is different from the control.

If the method with a constant control sample is used, the possible combinations of samples will look as follows: AkAB, AkBA, where Ak is the control sample and in other blocks. The rest of the procedures of the technique are identical to the one that uses a variable control sample.

**Method "Two out of five"** (two-out-of-five test) outlined in DSTU ISO 6658:2005 Sensory research. Methodology. General

instructions. The current version of the international standard is ISO 6658:2017 Sensory analysis – Methodology – General guidance.

The standard defines the two-out-of-five method as a variance method involving five coded samples, two of which are of one type and three of which are of another type. The tester is asked to group two sets of samples.

The "Two out of five" method is recommended to be used in the following cases:

– if only a small number of testers are working (eg 10);

– to establish the difference in a more economical way than when using other methods (the method is statistically more effective);

The disadvantages of this method are the same as in the case of the triangular method, except that its results are most affected by sensory fatigue and memory defects. It is used mainly to determine visual, auditory and tactile sensations.

The recommended number of testers is 10 or more.

The subject is given one set of five coded samples, two of which are of one type and three of which are of another type. The tester is asked to group two types of samples. If the number of testers is less than 20, the order of submission must be chosen arbitrarily from the following 20 options:

| | |
|---|---|
| AAABB | BBBAA |
| AABAB | BBABA |
| ABAAB | BABBA |
| BAAAB | ABBBA |
| AABBA | BBAAB |
| ABABA | BABAB |
| BAABA | ABBAB |
| ABBAA | BAABB |
| BABAA | ABABB |
| BBAAA | AABBB |

Scheme of presentation of samples in the "two out of five" method

General guidelines for adequate methods of statistical processing of the results of sensory studies in relation to the above-

mentioned methods of separation are specified in the DSTU standard ISO 6658:2005 "Sensory research, methodology, general instructions", as well as the standard corresponding to each method.

### 1.2.4 Descriptive methods

Descriptive methods are based on a verbal description of the organoleptic properties of the product. The description of organoleptic indicators is given in all standards and other normative materials that establish requirements for the quality of food raw materials, food and flavor products, it is widely used during the identification of food products - one of the most responsible procedures in commodity examination and certification.

These methods are applied to one or more samples for qualitative and quantitative characterization of one or more sensory attributes. They are classified according to DSTU ISO 6658:2005 as follows:

– conventional descriptive methods;

– quantitative descriptive methods and sensory profile methods.

It should be noted that the task of descriptive methods includes the use of precise terminology that does not allow for different interpretations.

#### Conventional descriptive method

The usual descriptive method (simple description test) is a method for obtaining a qualitative description of individual properties that are part of the general characteristics of the sample.

This method can be applied:

– to identify and describe the properties of a particular sample or samples;

– establishing the sequence in which these properties are distinguished.

This method is recommended for describing discrepancies that have been previously established. It is also useful for training testers; depending on the purpose of the method, such numbers of experts are recommended:

– to define and describe characteristics - 5 or more experts;

– to establish the sequence in which the properties are distinguished - 5 or more selected testers.

## Quantitative descriptive methods and sensory profile methods (quantitative descriptive and sensory profile tests)

This is research or theoretical methods for evaluating the sensory properties of a product using terms selected from a vocabulary previously compiled using simple descriptive methods. Individual properties that are part of the overall sensory characteristics of the sample are evaluated on an intensity scale, and the results are used to determine the sensory profile of the product. The method can be used to evaluate smell, taste, appearance and texture individually or in combination.

These methods are recommended to be used in the following cases:

– during the development of new products;

– to determine the nature of the difference between the products;

– for quality control;

– to receive sensory data for the purpose of correcting them with analytical data.

General recommendations for the use of sensory profile methods are contained in the international standard ISO 13299:2016 Sensory analysis – Methodology – General guidance for establishing a sensory profile.

## Profile methods

They are based on the fact that separate taste, smell and other stimuli, combining, give a qualitatively new feeling of the product's taste (flavor). To compile a description of the flavor of the product, one should identify individual properties that form a general impression of the product and evaluate their intensity.

The international standard ISO 6564:1985 Sensory analysis – Methodology – Flavor profile methods (the national version of DSTU ISO 6564:2005 Sensory analysis. Methodology. Methods for creating a flavor spectrum) considers a series of methods for

describing and evaluating the flavor of food products by specially trained testers.

These methods are used:

– in the development, modification and improvement of food products;

– in the characteristics of differences between products;

– in quality control;

– to complement the results of instrumental analysis;

– to ensure permanent registration of properties and characteristics of products;

– to monitor product changes during storage.

To perform descriptive analyzes of the product, the following procedures must be performed:

– identification of perceived characteristics;

– determination of the order of perception;

– assessment of the degree of intensity of each of the properties;

– aftertaste research;

– evaluation of the overall impression.

There are a variety of methods for performing descriptive flavor analyses, which can be divided into two categories: the first is one that results in an unanimous description of the flavor (as defined by the international standard, this is the "consensus method"); a second one which does not need consent; these methods are called independent. For each category of methods, corresponding refined methods are developed, as well as forms for presenting results.

Another international standard ISO 11036:1994 Sensory analysis – Methodology – Texture profile (Organoleptic analysis – Methodology – Texture profile) refers to special methods for compiling a profile description of the texture of food products (solid, semi-solid and liquid), as well as non-food products (for example, cosmetics) .

These techniques can be used to:

– selection and training of testers;

– providing assistance to testers by clarifying the formation of concepts and methods of evaluating textural characteristics;

– description of textural characteristics of the product for drawing up a standard profile in order to detect changes in the following stages;

– improvement of existing and development of new products;

– study of various factors affecting the textural properties of the product;

– comparing similar products to determine the nature and intensity of their textural differences;

– correlations of organoleptic and instrumental and/or physical measurements.

In accordance with the procedure for performing the profile method of analysis, the smell profile is first determined, then the taste and consistency profile. The tasting committee checks the profile of the reference sample several times. Standards can be chemically pure substances, which are key for this product in terms of smell or taste. According to the sample, the terminology of the definitions, the order of appearance and the intensity of the sensations are clarified according to the conventional scale. Various scales can be used to assess the intensity of characteristic features. An example of a verbal description of signs can be the following scale: 0 – sign is absent; 1 – only recognizable or felt; 2 – fairly clear intensity; 3 – moderate intensity; 4 – strong intensity; 5 - very strong intensity.

The results obtained by the profile method and statistically processed can be presented in the form of profiles of rectangles, polyhedra, profiles of semicircles or profiles of a full circle, and others.

This method can be used to characterize the profiles of individual quality indicators of products: appearance, smell, taste, or consistency. This method seems to be the most convenient for evaluating the quality of products with complex characteristics.

Food products with a complex chemical composition (vegetables, fruits), those that have undergone technological processing (wine, beer, confectionery, fish and seafood, smoked or fried meat, sauces, etc.), create the so-called spicy flavor.

In order to investigate what sensations the consumption of a

particular product leads to and to improve its quality, profiles of its properties, such as a savory or texture profile, are compiled. One technique is to present various samples of any product to a panel of experts who must describe the product in sensory terms. Descriptive terms are generalized, and those that occur most often are evaluated as an expression of a special feeling. The list of such terms compiled for the complete product is used when building a profile.

Various methods of graphical construction of profiles are used. he fig. 1.8 shows the taste profile of tomato sauce in the form of a semicircle or a full circle. The axes of the diagram correspond to the characteristic features of the product in the order of defining the features. The intensity of each characteristic is marked on the axes on a 5-scoring scale: tomato taste - 4, cinnamon - 1, clove - 3, sweet - 2, pepper - 1. By connecting the points on the axes, the taste profile of tomato juice is built.

Fig. 1.9 Profiles of organoleptic assessment of carp meat, which are built in the form of polyhedra, are shown.

The results of sensory research, designed in the form of profilograms, represent visual information that is necessary for the development of smoking preparations and flavorings with given properties.

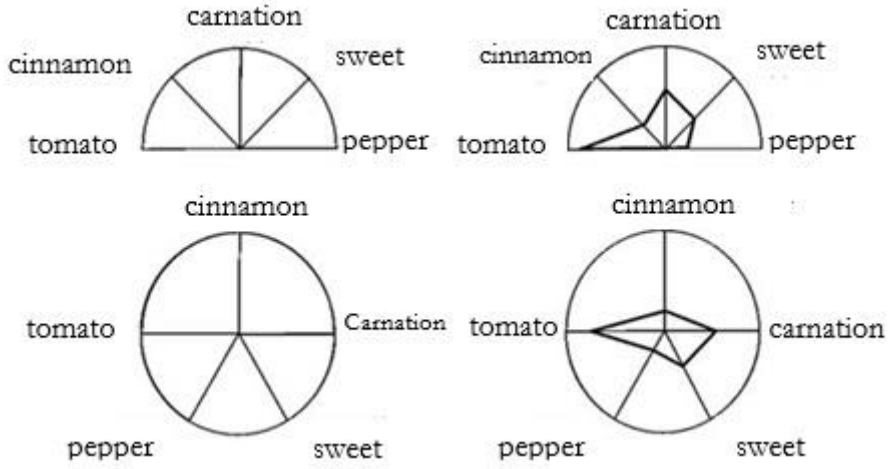



Рис. 1.8. Construction of the taste profile of tomato sauce in the form of a semicircle (a) or a circle (b)

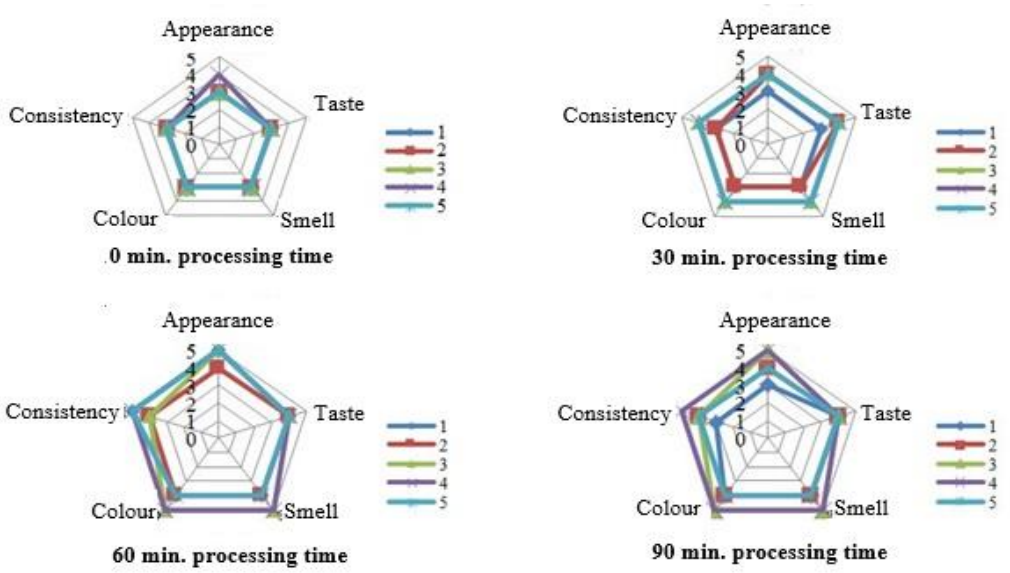



Рис. 1.9. Carp meat evaluation profilogram

In Germany (A. Kohan and M. Grimm) applied a profile method for sensory assessment of the quality of dessert chocolate. To characterize the appearance, four features were selected: gloss on the upper and lower sides; the presence of bubbles on the surface; moderation of stripes and spots; scratches and abrasions. The smell of chocolate was evaluated according to two characteristics: chocolate-cocoa aroma and impure complex. In the taste profile, 4 terms were used: cocoa aromatic, bitter, sweet, aftertaste. Consistency was assessed by four signs: difficulty biting; consistency that melts, finely dispersed and sticky. Each of the 4 signs was evaluated on a conventional five-scoring scale. Profilograms were built based on the summarized results of the tasters' evaluations.

The fig. 1.10 shows two options for the graphical expression of the results of the profile analysis.

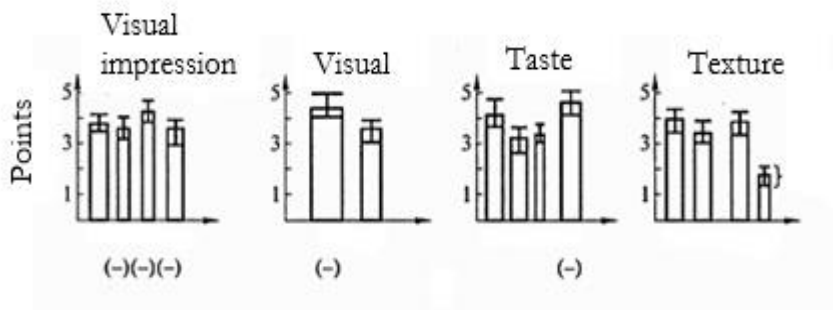



Fig. 1.10. Profiles of the quality of dessert chocolate is the profile of a rectangle

In the profile of the rectangle, its height is a measure of the intensity of the feature, the width reflects the significance (importance) of a partial feature in comparison with others. The sequence of rectangles from left to right corresponds to the sequence of perception of sensations. In one drawing, it is rational to combine partial signs of one property: appearance, smell, taste or consistency. It is possible to specify the trust area. Negative partial signs, for example aftertaste, impure complex, should be defined or indicated with a negative "minus" sign.

Semicircle profiles consist of one semicircle. Radial lines mean partial signs, which are applied clockwise according to the sequence of perception of sensations. Average intensity values are plotted along the radii. The points on the axes are connected. The shaded surface is the product quality indicator profile.

The fig. 1.11 shows an example of a profile of the sensory properties of a product in the form of a full circle. The most important partial features are located clockwise, intensities are laid out along the radius. In one figure, you can show several profilograms to compare the quality of samples with the standard or display the influence of the studied factor: technological modes, packaging and storage.

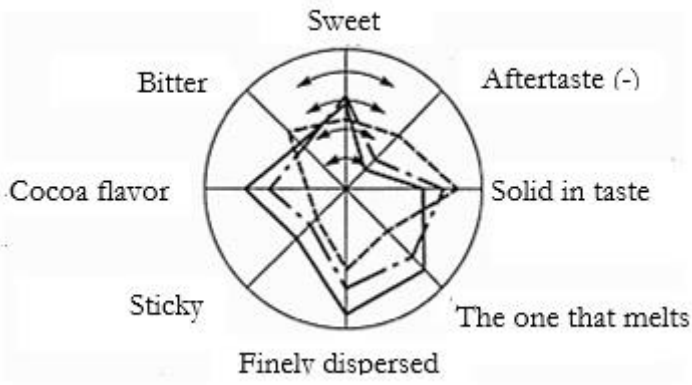



Fig. 1.11. Effect of storage period on sensory characteristics of dessert chocolate
(——) without storage; (– - –) after 10 weeks of storage; after 36 weeks of storage; (– – –) negative sign direction (given by A. Kohan and M. Grimm)

The profile method has great prospects in organoleptic analysis due to its flexibility and the possibility of adapting it to solve various tasks of a production research nature. The disadvantage of this method is that it is not always possible to express two different feelings with two distinctive descriptive terms.

### 1.2.5 Methods of scales and categories

The organoleptic indicators of products belong to immeasurable ones, the values of which cannot be represented in physical size scales. The characteristics of taste, smell, consistency and other sensory features are given in the form of qualitative descriptions. In order to translate quality into quantity, dimensionless scales are used: usually in points, sometimes in fractions of a unit or percentages.

The scoring scale is an ordered set of numbers and qualitative characteristics that are brought into line with the objects that are evaluated according to the specified indicator.

The scoring scale is intended to provide objects with a quantitative assessment, which is a measure of the expression of the qualitative equation of the characteristic.

Score scales are used for differentiated organoleptic analysis, which is performed by highly qualified tasters. This method allows you to establish the levels of partial (by individual indicators) and general (by a set of indicators) quality. The evaluation results are expressed in the form of points on a conditional scale with an increasing sequence of numbers, each of which corresponds to a certain intensity of one or another quality indicator. Provided that a scientifically based scoring system is used and other basic requirements are met, the method allows obtaining fairly objective, reliable, well-reproducible results.

In the world practice of organoleptic analysis, various principles of scoring scales are known. There are 3, 5, 7, 9, 10, 13, 30 and 100 scoring scales for the organoleptic analysis of food products.

5-scoring scales with the use of weighting coefficients (importance, significance) for individual quality indicators most fully meet modern requirements.

In order to unify the scoring scales, it is advisable to be guided by the following recommendations compiled based on the results of international developments:

- assessment of individual features of the product (appearance, smell, taste, consistency, etc.) should be carried out by an expert. For the work of tasters, a 5-scoring scale should be used, which provides for the characteristic of the product according to five qualitative levels. Such a scale is easy to use and can be used even by non-professional tasters: 5 points - excellent quality, 4 points - good, 3 points - satisfactory, 2 points - bad (food inferior product), 1 point - very bad (technical defect). When entering grades of 0.5 points, the scale is easily transformed into a 9-scoring scale, which is quite detailed and can be used for research purposes;

- for each type of product, you should develop schemes-tables containing a detailed description of the quality levels of individual characteristics for tasters. Five points correspond to the description of the features of the benchmark, which represents the highest (or global) level of product quality. Scores of 4 and 3 correspond to quality categories 1 and 2, respectively, in accordance with the

requirements of the standard for this product. To characterize quality indicators, it is advisable to use the terminology of the current standard for the evaluated product;

- the organoleptic evaluation of the product must be carried out by a specially trained team of tasters, consisting of 5-9 people with proven sensitivity, used for these purposes. The premises must meet the basic requirements for organoleptic analysis laboratories;

- during the statistical processing of tasting sheets, in addition to the arithmetic mean value of the scores, the root mean square or standard deviation should also be calculated, which is a good indicator of the unambiguity of the tasters' assessments. If the samples are homogeneous and the scores are unambiguous, then the deviation on a 5-scoring scale usually does not exceed 0.5 points.

In connection with the different significance of single signs in the general perception of product quality in the calculation of the generalized indicator, which is the sum of the products of the assessments of single indicators by the corresponding weighting coefficients, it is necessary to use them at the stage of processing the tasting sheets.

Scientifically based scoring scales of organoleptic evaluation, developed taking into account the stated principles, are simple, convenient to use and allow to reliably differentiate food products by quality.

During the development of scoring scales, the gradation of the scale is determined depending on the nature of the task, the qualifications of the experts, the required accuracy of the results, and the possibility of a verbal description of the characteristics of the quality levels.

The characteristics of the quality levels of the scale must meet the following requirements:

– *general usage* - prevalence of terms familiar to tasters;

– *ambiguity* – close interpretation by different experts;

– *differentiation* - the ability to distinguish signs on all scale levels;

– *adequacy* – the number of scale levels ensures the required accuracy of the results.

Among the numerous methods of organoleptic analysis, which belong to the group of scales and categories, the normative base (international and domestic) has the method of grouping (ranking) and the scoring method.

**Ranking method (grouping)**

This method is subject to the International Standard ISO 8587:2006 Sensory analysis – Methodology – Ranking and its national analogue DSTU ISO 8587:2005 Sensory analysis. Ranking methodology. These standards describe the method of sensory examination of a series of tested samples in order to place them in the required order (by ranks).

This method is used during the test for differences in the case of a large number of samples using the criterion of the intensity of individual indicators that reflect certain characteristics or create a general impression.

It is especially appropriate to use this method during pre-sorting of the test samples (then using other research methods) or in the case when testers cannot guarantee obtaining reliable results using other methods.

In addition, this method allows you to determine the impact on product quality of various raw materials, processing, packaging and storage processes.

This method can be used when training testers.

The essence of the method is that testers are given a series of samples in a random order, which they must classify in accordance with the given criteria (for example, the general impression of the product, a certain property or its individual characteristic). If a control sample is used, it is placed unidentified among other samples. Further, the obtained results are processed using statistical methods.

According to the research technique, testers evaluate the samples, which are presented in a random order, and assign them a certain rank depending on a certain criterion.

Each tester may be offered the same series of samples one or more times with different codes.

At the direction of the observer, the testers award the first rank to the sample with the strongest or weakest intensity of the

characteristic being evaluated (eg, strongest taste/mildest taste, sweetest/least sweet taste).

Testers should be instructed to avoid tying ranks. They should be informed that if they cannot find a large difference between the two samples, they should try harder. However, if they are unable to tell the difference between the samples, they should make a note of this on the answer sheet.

All evaluations registered in the appropriate forms by each examiner, for each study and each characteristic, are summarized in the form of a table, noting the examples of the linked ranking with the sign "equivalent" (=).

**Questions for discussion and self-examination**

1. What groups are organoleptic analysis methods divided into?
2. What groups of methods are analytical methods?
3. What methods make up the concept of "methods of consumer assessment"?
4. What methods are used during consumer evaluation of food products?
5. What is the preference method based on in consumer evaluation of food products?
6. Give the general characteristics of the verbal Hedonic scale and the Hedonic scale of persons.
7. What is "food drift"?
8. What are scoring scales?
9. What is the purpose of recognition methods of sensory research?
10. In what cases is the method of paired comparison used?
11. What is the essence of the "A not A" method (method of single stimuli) and in what cases is it used?
12. When is the method of triple comparison (triangular) used and what does it consist of?
13. What are the differences of the "Duo-trio" recognitory method?
14. In what cases is the "Two out of five" method used, what are its features?

15. What are descriptive methods based on and how are they classified?

16. What is the usual descriptive method used for?

17. In what cases are quantitative descriptive methods used?

18. For what purposes are profile methods used?

19. What are the methods of graphical construction of profiles?

20. What scoring scales are used in the practice of organoleptic analysis?

21. What recommendations should be used when using scoring scales?

22. What is a "generalized quality indicator"?

23. What are the weighting factors of quality indicators?

24. What is the main requirement that scoring scales must meet?

25. When is it appropriate to use the ranking (grouping) method?

*Topic 1.3. Preparation and organization of the work of expert tasters*

Obtaining the optimal effect with sensory methods of assessing the quality of food products in the vast majority of cases depends on the qualifications of the tasters. Their selection requires special care, since the positions of financial and time costs are a long-term investment project. In the most complete and systematized form, the practical issues of training expert tasters are reflected in the international standards ISO 8586-1:1993 *Sensory analysis. General guidance for selection, training and monitoring of testers*. Part 1: Selected assessors and ISO 8586-2:1994 *Sensory analysis. General guidance for selection, training and monitoring of testers*. Part 2: Experts (Sensory analysis. A general guide to the selection, training and monitoring of testers. Part 2: Experts).

Sensory evaluation can be performed by three types of researchers: testers, selected testers and experts.

**Testers** can be both untrained and involved individuals with experience in sensory work.

**Selected testers** are individuals who have passed preliminary selection and special training. In the category of experts, two groups are distinguished: expert testers and specialized expert testers.

**Expert testers** are selected testers with high sensitivity to sensory stimuli, who know the methodology well and are able to conduct reliable and reproducible evaluation of various products. Compared to the selected testers, they are able to store in memory the sensory characteristics of the reference samples for a long time.

**Specialized experts -** testers have the skills to work in a specific field of technology, are well versed in the characteristics of the product under study, and the structure of marketing. Specialists in this category are able to find the relationship between sensory evaluation and technological factors (raw materials, formulation, technological processes, shelf life, etc.). As a rule, specialized experts improve their knowledge of one or a group of products of the same type. Thanks to a high level of knowledge of specifics and experience, specialized testing experts can predict changes in the sensory characteristics of products depending on changes in the

formulation, manufacturing technology, as well as in the storage process.

The preliminary selection of candidates for the tester is carried out at the stage of their invitation, the final - after the completion of the entire period of training and taking the prescribed tests.

The procedure for selecting testers includes:

- invitation and preliminary selection;
- testing of candidates in the examiner;
- training of candidates in identified testers;
- selection and training of identified testers;
- formation of a group specializing in certain methods of sensory analysis;
- training and selection of candidates for experts.

In certain cases, especially for the formation of a group for descriptive analysis, it is possible to prepare specialized subgroups. In the future, the monitoring of the abilities of the selected group is carried out regularly to support and develop the necessary abilities.

### 1.3.1. Selection, theoretical training and training of tasters

When selecting tasters, the most important thing is the theoretical validity of the measurements used and the methodological approach. The selection of tasters can be carried out by methods of psychological diagnosis, which involve the assessment of the abilities of individuals, for example, the sensitivity of analyzers, attention, memory, mental and linguistic motives of behavior, attitudes towards oneself and other people, etc. The suitability of a person for a certain activity is assessed on the basis of the results of methodological tasks, and the objectivity of the procedure is based on the analysis of a person's activity and the identification of professionally important qualities, the selection of methods of their measurement, the development of criteria for numerical assessment of the degree of suitability of the subjects and ensuring the reliability of the selection results.

The assessment of the professional suitability of tasters is carried out according to such features as sensory sensitivity, professional awareness, conformity, as well as dynamic attitudes in the form of habits, the influence of authorities, a sense of self-confidence and interest in work. The share of each feature in the assessment of the professional suitability of the test subject is different and is approximately (%): sensory sensitivity - 40, professional awareness - 20, conformity - 30 and dynamic attitudes - 10. The given features are a single whole and do not involve replacing each other. The stages of preparation of tasters are clearly represented by a block program (Fig. 1.12 and 1.13).

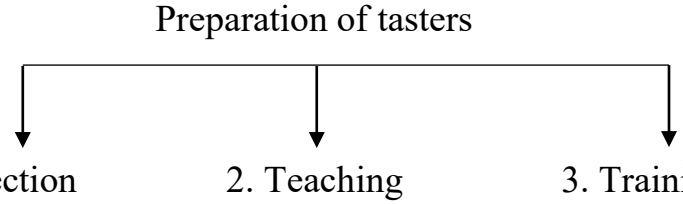
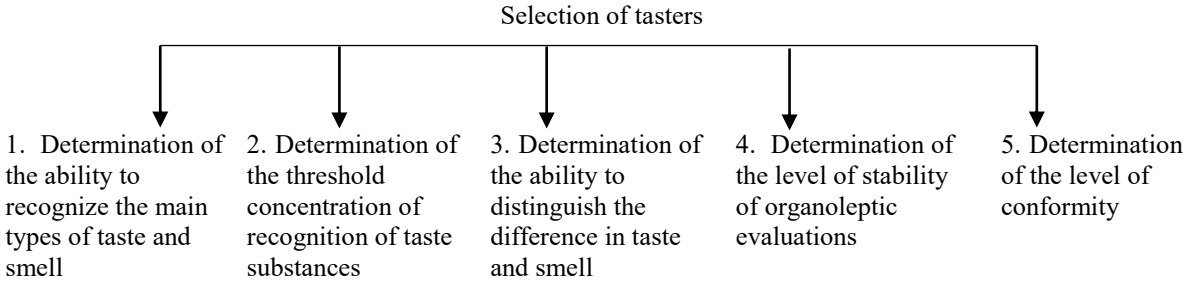
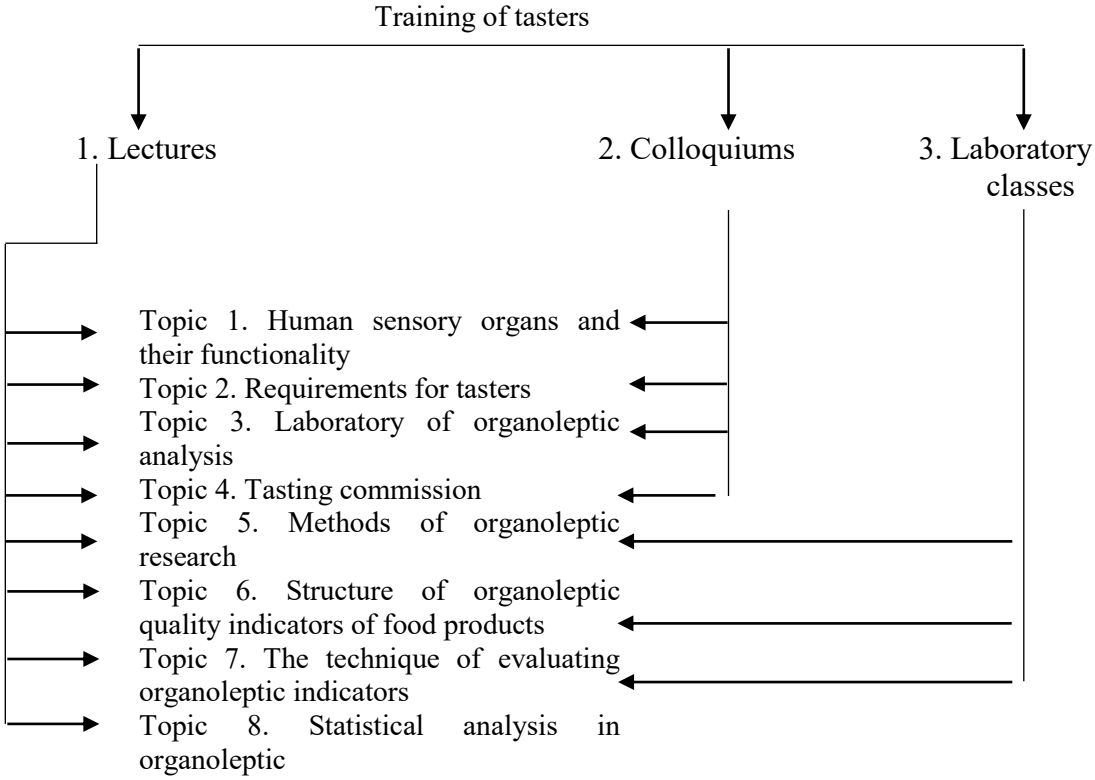



Fig. 1.12. The structure of the block program of the first level of consideration

**Choice of tasters.** Persons with good sense of smell, taste and vision, who are able to perceive tactile irritations, are involved in the work as tasters. It is necessary for the examiner to have the ability to accurately perceive any shades of smell and taste and to professionally and impeccably find out the nature of each of them. When selecting a taster for organoleptic quality analyses, in which visual assessment plays an important role, attention is paid not only to the acuity of his vision, visual memory and experience, but also to the person's observation skills.


Selection of tasters
1. Determination of the ability to recognize the main types of taste and smell
2. Determination of the threshold concentration of recognition of taste substances
3. Determination of the ability to distinguish the difference in taste and smell
4. Determination of the level of stability of organoleptic evaluations
5. Determination of the level of conformity

a


Training of tasters
1. Lectures
2. Colloquiums
3. Laboratory classes
Topic 1. Human sensory organs and their functionality
Topic 2. Requirements for tasters
Topic 3. Laboratory of organoleptic analysis
Topic 4. Tasting commission
Topic 5. Methods of organoleptic research
Topic 6. Structure of organoleptic quality indicators of food products
Topic 7. The technique of evaluating organoleptic indicators
Topic 8. Statistical analysis in organoleptic

b

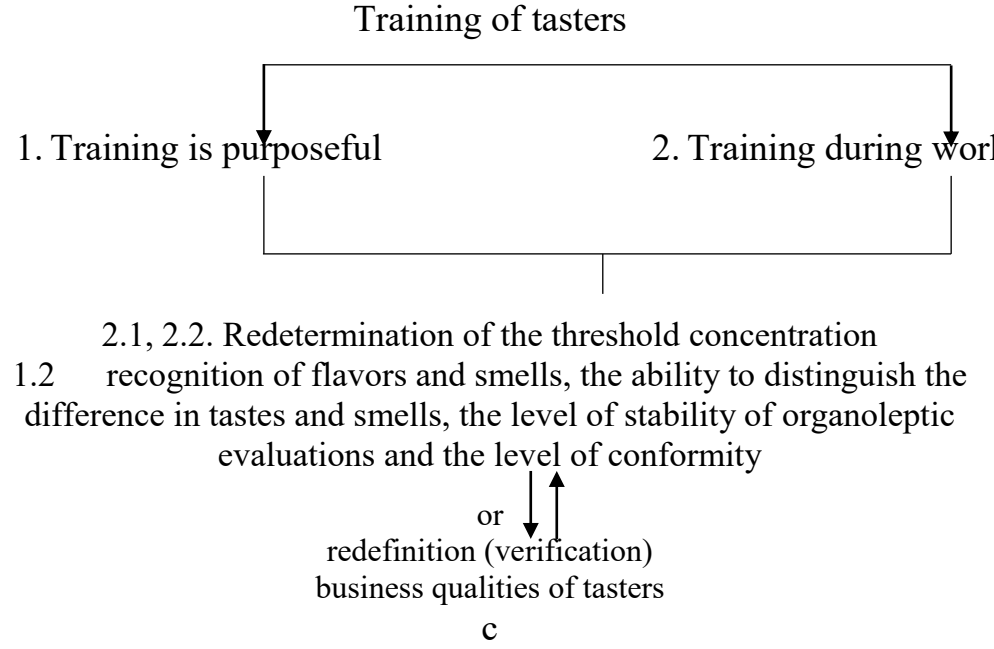



Fig. 1.13. The structure of the block program of the second level of consideration: a, b, c – selection, education and training of tasters, respectively

A valuable trait of the taster's character is the ability to ignore extraneous stimuli and focus on certain stimuli, quickly analyze perceived sensations, draw correct conclusions and remember the nature of each sensation for a long time.

Currently, there are many methods of testing a person's sensory sensitivity, which allow assessing the individual's ability to recognize stimuli and perceive them, to differentiate different thresholds of perception, based on which the testers are divided into categories.

Determination of taste sensitivity includes two stages. At the first stage, the tasters' ability to distinguish the main types of taste is determined or the presence of ageusia is detected, for which the tasters are presented with a series of coded samples of standard (reference) substances in the form of aqueous solutions of a given concentration (Table 1.1) and in a specified order. After each test, tasters identify the taste and record scores. The number of series of

samples should correspond to the number of testers, and the order of presentation of standard solutions does not involve returning to previously tested samples (Fig. 1.14).

**Table 1.1. Reference substances corresponding to the main categories of taste**

| Taste | Reference substances | Concentration, g/l |
|---|---|---|
| Sour | Crystalline citric acid (monohydrate) | 1,00 |
| Bitter | Crystalline caffeine (monohydrate) | 0,50 |
| Salt | Anhydrous sodium chloride | 5,00 |
| Sweet | Saccharose | 16,0 |
| Metal (acidified) | Iron sulfate hydrate (II) $FeSO_4 \times 7H_2O$ | 0,01 |
| "Umami" (spicy) | Sodium glutamate | 2,00 |

**Flavor identification checklist**

Name _____ Date _____

Task: determine the type of taste of the presented samples and mark your sensations as follows: if you can clearly feel this type of taste, put a plus "+" in the corresponding column, if the character of the taste is not clear, then put a plus "+" in the column "taste not defined"

| Code | The taste is not defined | Sour | Bitter | Salt | Sweet | Metal | Umami |
|---|---|---|---|---|---|---|---|
| 135 | + | | | | | | |
| 567 | | | + | | | | |
| 874 | | + | | | | | |
| 984 | | | | | + | | |
| 171 | | | | + | | | |
| …. | | | | | | | + |
| 674 | | | | | | + | |

Fig. 1.14. Example of a flavor identification checklist

The second stage of the test is related to the determination of individual taste sensitivity or the threshold of recognition of taste substances. To determine the recognition threshold, each candidate is

given two samples of the reference substance (Table 1.2) and one sample of water or neutral medium, or vice versa - one sample of the standard substance and two samples of water (neutral medium).

**Table 1.2. Concentration of aqueous solutions of reference substances, g/l**

| Reference substance | Concentration in aqueous solution at room temperature |
|---|---|
| Caffeine | 0,27 |
| Citric acid | 0,60 |
| Sodium chloride | 2 |
| Saccharose | 12 |
| Cis-3-hexen-1-ol | 0,4 (ml/l) |

Candidates who have passed the selection are considered to be those candidates who correctly identified a sample different from water. Failure to detect a difference after several replicate determinations indicates that the candidate is unsuitable for this type of analysis. An example of a control sheet for determining the sensation threshold is shown in Fig. 1.15.

Checklist for determining the threshold of sensation

| Full name | | |
|---|---|---|
| Date: | | |
| Sample code | Feeling | |
| | Water (no incentive) | Not water (stimulus present) |
| 345 | + | |
| 872 | | + |
| 654 | + | |

Fig. 1.15. An example of a checklist for determining the threshold of sensation

The value of the threshold of individual impulses is constant, but only for a given person and under certain conditions. In changed conditions, in particular, with the onset of fatigue, malaise, nervousness or absent-mindedness, vulnerability decreases, and, therefore, the value of the differential threshold increases and can be several times higher than normal. The value of the threshold of vulnerability can be significantly reduced if you train the ability to quickly focus attention on this type of impulse.

Qualified tasters tend to have lower thresholds of sensitivity to the influence of taste impulses encountered most often during the performance of organoleptic evaluations. To carry out this part of the test, a series of solutions with increasing concentration of the reference substance is prepared, and the first sample is water. The last sample with the maximum content of the taste corresponds to the concentration of the solution, which is accepted for the substance of this type of taste when checking for the presence of ageusia.

A series of coded samples is presented in order of increasing concentration. Within each series of samples, three additional samples containing dilutions of the same concentration as the previous ones are added to eliminate the knockdown reaction. Tasters sample the contents of each vessel, using 10-15 ml of liquid. Tasters should record the results immediately after each test.

An example of a control sheet is shown in Figure 1.16. It is recommended to evaluate the taste of no more than three samples during one session to avoid fatigue of the senses. The next evaluation of another taste is carried out after a certain time, so that the tasters rinse the oral cavity and remove the aftertaste. The results of such a test are evaluated individually, since each taster has an individual type of sensitivity that can change over time and can improve significantly due to constant training.

| Full name | | |
|---|---|---|
| Date: | | |
| Task: determine the taste of the presented samples and mark your sensations: 0 - no sensations, +, ++, +++, ++++ - a difference in the intensity of the pulse is felt (+ is added when an increase in intensity is felt). When the flavor is defined, write its name | | |
| № | Sample code | Feeling |
| 1 | 563 | 0 |
| 2 | 873 | 0 |
| 3 | 365 | + |
| 4 | 489 | + |
| 5 | 987 | ++ sour |
| 6 | 654 | ++ |
| 7 | 873 | +++ |
| 8 | 321 | +++ |
| 9 | 543 | +++ |
| 10 | 109 | ++++ |
| 11 | 342 | ++++ |
| 12 | 911 | +++++ |

Fig. 1.16. An example of a checklist for determining the recognition threshold and differential threshold

When determining the sensitivity of smell, tasters are tested for the ability to recognize the smell of at least ten individual substances found in the aroma of food products. The choice of substances is due to a number of such limitations as the harmlessness of compounds for the human body, availability in pure form and the possibility of preserving native properties for a long time.

Full name_____

Date:_____

Task: put a mark (/) on the scale that corresponds to the intensity of the salty taste in the sample

| Code | Scale |
|---|---|
| 453 It is not felt _____ | It feels strong |
| 317 It is not felt _____ | It feels strong |
| 914 It is not felt _____ | It feels strong |
| 503 It is not felt _____ | It feels strong |

Fig. 1.17. An example of a checklist for tests using scales

The set of aromas used in the research and training of tasters consists of aromatic substances representing different odor groups (sour, terpene, floral, burnt, etc.). As a rule, for this purpose, food flavorings and substances used to test subjects for anosmia are used (Table 1.3). It is also recommended to include odors representing certain defects (musty, ammonia, petroleum).

Odor recognition is carried out in one of three ways: odor evaluation in flasks where specially treated strips of fabric or paper are stored, evaluation of the strips directly, and evaluation of odors in capsules. In addition to these, such pharyngonasal methods of odor recognition are used, such as odor evaluation in the gaseous phase and by swallowing aqueous solutions.

**Table 1.3. Examples of flavoring substances used for odor testing**

| The name of the substance | Concentration (in alcohol solution), % | Scent |
|---|---|---|
| Ammonium hydroxide | 1,0 | Sharp suffocating |
| Grated camphor | - | Spicy, camphorous |
| Vanillin | 0,02 | Vanilla |
| Oleic acid | 2,0 (water solution) | Silage |
| Diacetyl | 0,1 (water solution) | Sour butter |
| Amyl acetate | 0,01 (water-alcohol solution 90:10) | Banana, fruity |
| Anisaldehyde or benzaldehyde | 0,01 (water-alcohol solution 50:50) | Amygdalaceous |

The test of the ability to recognize odors is carried out in two stages, and in the first stage the researcher characterizes his feelings for each of the odorous substances presented, and in the second stage he identifies these substances.

The smell of individual samples is determined by repeated inhalation, and the rest between samples of individual odorous substances is about 1-2 minutes. After conducting the first stage of the test, in order to improve the memorization of smells, the tester is told the name of the substances that caused him the corresponding associations (Fig. 1.18). In the second stage, odorants and one control sample are inhaled again to identify odors. The order of administration of inhaled samples compared to the first stage of the test is changed to avoid memorization. The subject's task is to correctly recognize all substances and enter their names on the control sheet (Fig. 1.19).

**Odor identification checklist**

Full name _____

Date:_____

Task: identify the smell of the presented samples of odorous substances and write down the name of the substance or your sensations, including associative ones, in the appropriate column

| Code | The name of substances or a description of the sensations or associations they cause |
|---|---|
| 453 | |
| 317 | |
| 914 | |
| … | |
| 503 | |

Fig. 1.18. Example of an odor identification checklist

**Odor identification checklist**

Full name_____

Date:_____

Task: identify the smell of samples of odorous substances and write in the appropriate column the name of the substance that you identified in each sample

| Code | Identified substance |
|---|---|
| 453 | |
| 317 | |
| 914 | |
| … | |
| 503 | |

Fig. 1.19. Example of a checklist for identification aromatic substances

It should be noted that in practical work, tasters do not need to call substances by their chemical names, since many different chemicals can smell the same. At the same time, it is very important that the taster learns to correctly operate with the appropriate terminology used to describe the perceived sensations, as well as to

associate the offered smells with the smells of food products.

If errors are detected in the recognition of the smell of some solutions, inaccuracies or the impossibility of recognition, the tester repeats the procedure. If the smell is not recognized again, the examiner states anosmia.

The next stage of the selection of tasters is the verification of the ability to determine the change in the intensity of the aroma of the sample, that is, the determination of the differential threshold. In this case, the taster must determine the qualitative difference in the intensity of the aroma pulse in the samples being compared, similar to the determination of taste thresholds.

Since each tester has an individual type of olfactory sensitivity, the results are evaluated differently. The taster's level of sensitivity can be greatly improved by training, the essence of which is as follows. Candidates are offered four samples of varying intensity of aromatic characteristics to be arranged in ascending order.

To assess the intensity of the odors of the samples, it is possible to use different scales that allow to classify or rank them according to any criteria, and the order of presentation of the samples to each of the candidates should be random. Similar tests are also carried out for taste, color characteristics and consistency of products (Table 1.4).

**Table 1.4. A substance used for sensory tests**

| Test type | Sample examples |
|---|---|
| Recognition of taste | Citric acid solutions of different concentrations |
| Odor recognition | Isoamyl acetate |
| Recognition of consistency parameters | Samples of products are selected from the assigned tasks |
| Color recognition | Color scales |

The next stage of selection and training of testers is the assessment of the possibility to present their own sensory perception.

In order to conduct the aroma description test, candidates are

provided with 5–10 aromatic samples reflecting the characteristics of the products with which the tasters have to work (Table 1.5).

**Table 1.5. Examples of substances used for aroma description tests**

| Substance | The association most associated with aroma |
|---|---|
| Benzaldehyde | Cherry |
| Octen-3-ol | Fungal |
| Phenyl-2-ethyl acetate | Floral |
| Diallyl sulfide | Garlicky |
| Camphor | Camphor, medical |
| Eugenol | Allspice |
| Anethol | Anisic |
| Vanillin | Vanilla |
| 3-ionone | Violet, strawberry |
| Acetic acid | Acetic |
| Isoamyl acetate | Fruit, banana |
| Dimethylthiophene | Fried onions |

The aroma intensity of the presented samples should be slightly above the recognition threshold level. Two methods of sample delivery are used: direct and retronasal. The essence of the direct method is to evaluate samples directly in capsules, flasks or aromatic strips. With the retronasal method, odors are evaluated in the gaseous phase by introducing aromatics into the oral cavity. strips or aqueous solutions of substances.

Candidates are then asked to describe the scent of the sample using specific terms or associatively. In case of difficulties, the test organizers discuss the difficulties with the entire group of testers.

The results of the test are evaluated according to the following system: 3 points - for correct identification of the smell and description using specific terms or the most common associative characteristics; 2 points - for description in general terms; 1 point — for identification or description of the relevant association in the discussion process; 0 points - in case of inability to perceive this

aroma. Candidates who score less than 65% of the total marks are considered unfit to take this type of test.

To describe parameters of consistency or texture, candidates are given a series of samples in random order and asked to describe their parameters. Solid samples should be served in equal-sized pieces, and liquid samples - in special vessels of the same size and shape.

According to the sensitivity of the sensory system, tasters are divided into four groups: sensitive, medium, satisfactory and low sensitivity. The sensitivity of the sensory system of the subjects should be correlated with the established differences as a product. To work as food tasters, it is recommended to choose persons who have a sensitivity of the sensory system not less than satisfactory. The results of human sensory sensitivity tests can also be evaluated by the percentage of correct answers. It is believed that when selecting tasters of average sensitivity, the possibility of the number of correct answers should be in the range from 65 to 75%, and for tasters with a sensitivity higher than average, the number of correct answers should exceed 80%.

The professional awareness of tasters is determined by the presence of relevant knowledge in the field of commodity science, production technology, psychophysiological processes that take place during sensory research, as well as the level of development of sensory abilities, which consist in the conscious application and suppression of subjective factors.

Dynamic settings play a big role in organoleptic analysis: the efficiency of the work increases with the rise of the taster's interest in it and the degree of his self-confidence.

Bias in sensory evaluation can be caused by adaptation, fatigue, boredom, monotony, and even the spatial location of the sample, as preference is unconsciously given to the sample from the right or left side, regardless of real differences between them.

Tasting commissions are formed from the candidates selected taking into account the listed factors.

*Teaching*. Special training is required to develop testers' ability to detect, recognize and describe sensory stimuli. As a rule, the

training is focused on those products with which the selected tasters will have to work. The number of tasters undergoing training should be 1.5-2 times more than the final tasting commission. To develop tasters' correct understanding of the principles of sensory evaluation, all training is conducted in appropriate conditions.

During the training of persons selected to work as tasters, issues of theoretical training should be in the foreground. For example, if students of technological specialties study organoleptic analysis only in general and for a very short period, then advanced training in the field of sensory analysis should be carried out in the process of working in tasting commissions of enterprises and research organizations, as well as in advanced training courses. It is extremely important to provide the tasters with basic knowledge of the production technology of the evaluated products and, if possible, to organize a visit to the relevant production.

*Training*. Selected and theoretically trained tasters constantly improve their professional level and conduct periodic training, since the experience of evaluating products obtained once is stored in the memory only for a certain time. The training includes introducing tasters to the achievements of sensory methodology, increasing individual ability to recognize, identify and evaluate organoleptic signs of product quality, improving sensory sensitivity and memory.

### 1.3.2. Formation of the tasting commission

To ensure high reliability of organoleptic test results, the tasting is usually conducted by several specialists who are part of the tasting commission (group, bureau, panel).

The tasting commission is formed from the number of persons who have passed the sensory sensitivity test and are suitable for the organoleptic evaluation of food products, as described above. Depending on the assigned tasks, the tasting commissions are divided into production and research commissions. The first ones are designed to determine the quality of the product and establish the reason for its possible decline, while the task of the second commissions is to determine the relationship between individual quality indicators, improve methods of organoleptic analysis, and

solve other scientific problems.

Production tasting commissions include tasters who have average sensory sensitivity and theoretical training sufficient to evaluate the quality of products by comparison methods and to write a verbal description of their organoleptic properties. The tasters included in the research commissions are subject to increased requirements regarding sensory sensitivity, theoretical training and degree of training, as they must ensure high accuracy and reproducibility of results, be able to perform profile and quantitative descriptive analyzes and other types of organoleptic research.

The necessary number of tasters to assess the quality of fish products, as practice has shown, is five to nine people. It is recommended that new members of the tasting commission be introduced gradually, and their education and training is carried out in the course of the work of the commission and communication with experienced tasters.

The tasting commission is prepared and headed by the chairman, whose tasks include planning organoleptic studies and interpreting the results, contacts with specialists interested in the results of product evaluation, cooperation with product quality control bodies and specialists from other areas of knowledge. The head of the tasting commission also carries out a preliminary selection of candidates for the training of new tasters, conducting interviews with them and finding out the degree of employment, personal interest, state of health of the taster, the ability to express their feelings in a concrete form, and even explaining what functions should be performed later by taster. In this regard, the chairman must have extensive knowledge in such areas as food technology, organoleptic research and mathematical statistics.

The tasks of the deputy chairman of the tasting commission include organizing research, providing necessary information and providing assistance to the chairman of the tasting commission. His main qualities should be high contact, diligence, efficiency.

Combining the functions of the head of the tasting commission and his deputy is not recommended in order to avoid possible psychological pressure on the tasters, the latter is a negative impact

on the reliability of the organoleptic analysis results.

Before the work of the tasting commission begins, the chairman instructs its members in detail, explaining the goals and methods of research. Products prepared in conditions close to the usual for this type of products are presented for evaluation. Samples must be the same for all tasters. For the convenience of recording the results and excluding their identity, the samples are encrypted. Tasters should be guided by the instructions developed for specific cases, which contain, for example, an evaluation table, a verbal description of each quality level of a given type of product, and a method of determination.

Each taster evaluates products individually in a specially equipped laboratory, records the results of his work in a tasting sheet, which is handed over to the technical group of laboratory workers after filling it out. The results obtained by a group of tasters are reduced to a protocol and processed using mathematical statistics methods. Based on the generalized results, a conclusion is given about the quality of the evaluated products.

The work of tasting commissions is generally judged by the reproducibility of product evaluation results, which is determined in ring experiments, when at least five well-proven tasting commissions of five to ten tasters work simultaneously with identical products and under the same conditions. The study should be subjected to the order of ten samples, which are presented to the participants of ring experiments in a coded form. The code is arbitrarily chosen three-digit numbers. Each of the ten samples is examined by tasting commissions twice. Samples should not be the same among themselves in terms of quality, which is ensured by different periods of their preliminary or intermediate storage and the use of other techniques.

Since the organoleptic tests in the ring experiment are carried out in most cases in different places, but at the same time, it is important to ensure the homogeneity of the samples, which is achieved by observing special precautions during the preparation, transportation and storage of the samples.

The reproducibility of the results of the organoleptic tests of

the tasting commissions is characterized by repeatability and comparability.

**Repeatability** is a quantitative expression of the magnitude of random errors of the tasting commission, when it receives two different evaluation results of the same food product sample in the same composition under the same test conditions on the same day.

**Comparability** is a quantitative expression of the amount of random errors that occur when different tasting commissions obtain different evaluation results of the same sample of a food product under similar test conditions. The ring test is set so that the statistical reliability of the test results is at least 95%.

Repeatability confirms, first of all, the correctness of the assessment of the product by the tasting commission during its organoleptic testing. Comparability can also be used to assess product quality criteria adopted by the tasting commission.

Depending on the type of product and the taken quality criterion, the average values of repeatability and comparability fluctuate within certain limits. For example, for meat and dairy products, they are, respectively: according to taste - 0.79 and 1.17; smell - 0.85 and 1.26; consistencies - 0.56 and 1.09; appearance - 0.53 and 0.91.

### 1.3.3. Sensory analysis laboratory

Creating the necessary conditions for conducting organoleptic research increases the effectiveness of tasters' work.

**Work room.** Sensory analysis should be carried out in a special testing laboratory. The main principle of designing a laboratory for sensory evaluation is to create a separate environment for each taster with constant controlled external conditions aimed at reducing the influence of psychological and physiological factors of the taster's condition on the result.

A typical organoleptic analysis laboratory designed for tasting should include:

1) premises for the preliminary preparation of samples, where packaging is removed from products, if necessary, they are defrosted, cans are opened, products are cut and heated, etc.;

2) premises for preparation of warehouses for the selection of tasters and their training, encryption of samples, conducting experimental work, statistical processing of results;

3) additional premises for storing samples, dishes, inventory;

4) an audience for educational and advisory work;

5) tasting room.

The placement of auxiliary premises should provide free access to dishes, storage places for samples, cabinets with forms, etc.

In the room for organoleptic assessment, two options for placing tasters should be provided: in separate booths (individual workplaces) and at a common tasting table (preferably round, the inner part of which rotates) for sensory analysis, discussion of results and development of a collective opinion.

Only organoleptic tests are conducted in the tasting room. The utility room should be located in such a way that it is convenient to transfer samples prepared for analysis and used utensils. It is recommended to isolate this room from the tasting room. It should not be passable or located in front of the room where the organoleptic analysis is carried out. Tasters should not visit the sample preparation room to avoid receiving information that could influence their evaluation of the products.

Equipping the utility room with inventory depends on the goals of the research. The utility room should be equipped with a sink with warm and cold water, a dish drying unit, a ventilation system, a refrigerator for storing samples, a thermostat for maintaining a constant temperature of samples, etc. In the utility room there should be devices for cutting products such as slices, canning knives and other equipment.

The laboratory must be equipped with airtight containers for collecting food waste, packaging material, containers, used disposable dishes, etc.

The area of the laboratory should be at least 36 m2, of which 50% is intended for the tasting room. The plan of the approximate location of the premises of the organoleptic analysis laboratory and their corresponding equipment is presented in Figure 1.20.

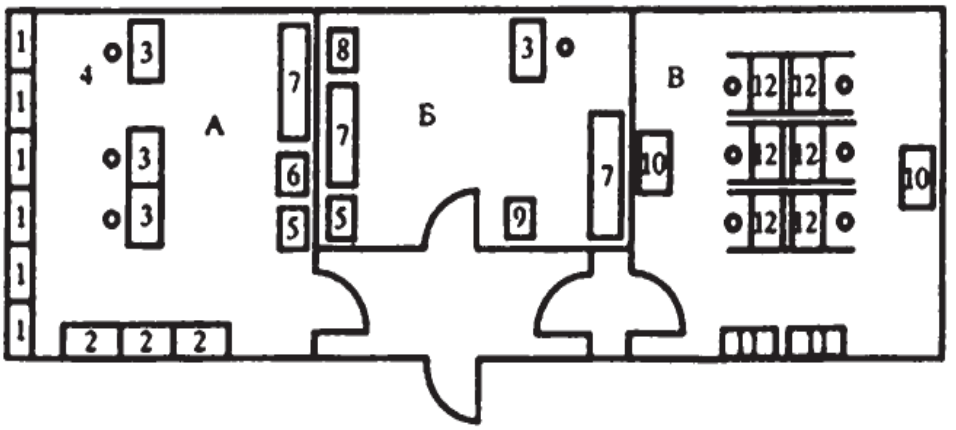



Fig. 1.20. Organoleptic analysis laboratory planning:
A - room of the technical group and preparation of solutions; B - the same for the preparation of stored samples; B-tasting room;
1 - bookcases; 2 - wardrobes for outerwear and robes; 3 - desks;
4 - chairs; 5 - shells; 6 - dish dryer; 7 - laboratory tables; 8 - electric stove; 9 - refrigerator; 10 - tables for forms filled out by tasters;
11 - the same for short-term location of samples prepared for analysis; 12 - tasting booths

There are various options for solving the layout of the laboratory depending on the tasks performed by its team and economic opportunities (Fig. 1.21).

**Individual workplace.** In most cases, it is necessary to obtain an assessment from each taster individually and independently of the assessments of other people. In order to avoid the distraction of tasters in the process of sensory analysis and to obtain independent results, the work should be carried out in individual cabins (Fig. 1.22).

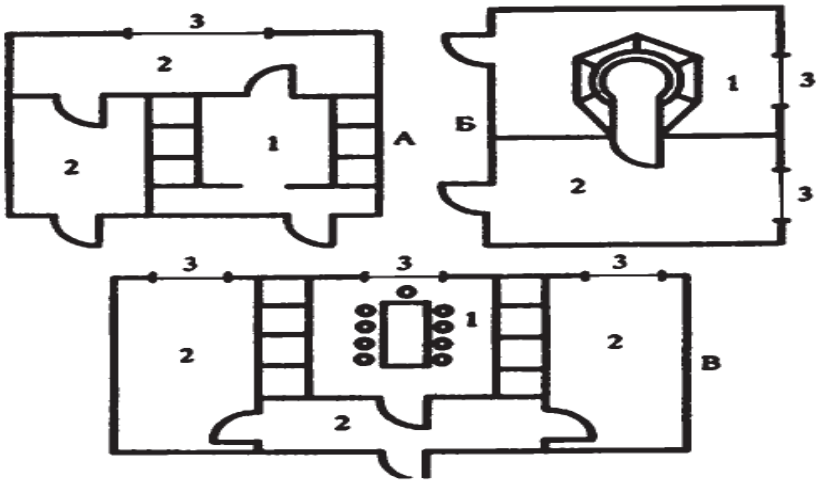



Fig. 1.21. Planning of premises for tasting analysis without a common tasting table (A) and for collective work (B, C): 1 - sensory analysis laboratory (room for work of tasters); 2 - utility rooms; 3 - windows.

Fig. 1.22. Individual cabins for work of tasters

The number of cabins depends on the availability of sufficient space for their placement and the tests that are usually carried out in this room. The minimum number of cabins should be at least three, and the optimal number of cabins is fifty. This number of seats for workers is selected based on the availability of space (territory) for movement and the convenience of delivering samples from the preparation area.

The equipment of the workplace of tasters must meet all modern requirements (Fig. 1.23).

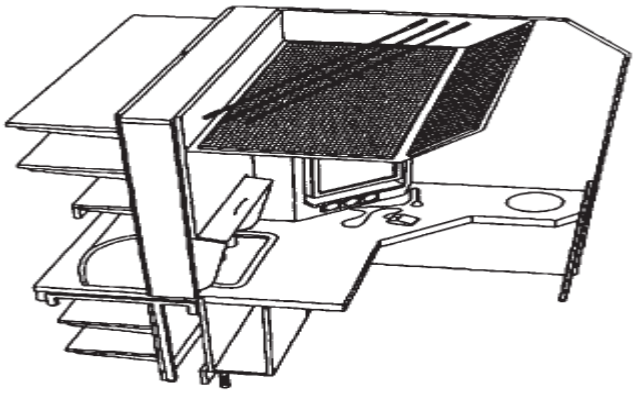


Fig. 1.23. Workplace of the taster

Individual cabins are tables with hinged partitions in front and on all sides, which allows you to remove them when the laboratory is used for other purposes. Individual booths can be created using screens similar to those used in medical procedure rooms.

The tasters sit at the work tables facing the wall, and from the back open side they are presented with the tested samples and remove the used dishes. The recommended width of each workplace is about 1 m, depth - 0.55 m, height - about 0.75 m. The height of the table should be comfortable for the taster when working with the samples. Cabins must have distinctive inscriptions (numbers) that allow identification of the cabin and determine which researcher works in it.

Chairs should be comfortable with the ability to change the distance from the floor to the seat. The working chair should have a height that is consistent with the height of the working surface of the table, the recommended distance between the seat and the working surface is 0.35 m. If the seat is not fixed rigidly, it should have a device for smooth movement.

It is desirable to install a sink to the left of each table, as in a dental office. It is impractical to install sinks with taps, as it is difficult to control the temperature of tap water. In addition, ordinary sinks are sources of extraneous odors, and water faucets make noise.

It is better to pour mouthwash water in advance, before the tasting, so that it has room temperature when the tasters start working.

Typically, booths for individual work are arranged in one line along the wall that separates the tasting room from the sample preparation laboratory. In some cases, a fan-shaped arrangement of cabins is practiced.

If it is not possible to equip the room with separate cabins, then it is allowed to use screens or special tables for sensory analysis, or tables with folding and removable partitions (Fig. 1.24). In the absence of partitions, places for tasters are placed one after the other at separate tables. The laboratory should have 5-9 workstations for tasters and one for the head of the tasting commission. The chairman's workplace should be located in such a way that he can see all members of the commission.

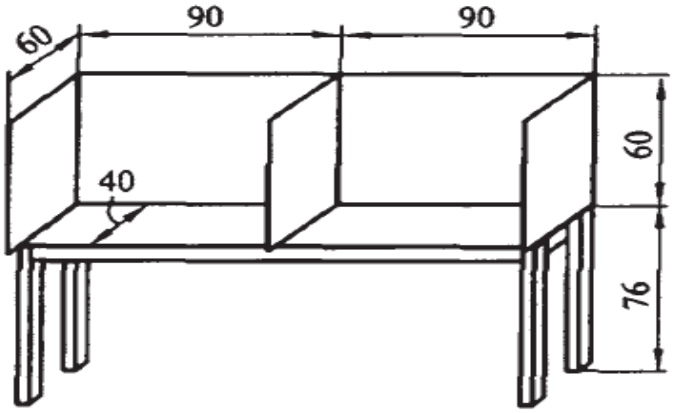



Fig. 1.24. A working table for sensory analysis, designed for the individual work of two tasters

In addition to the tasters' workplaces, the tasting room needs a table (or shelves) for placing samples and vacated dishes, as well as a table for forms filled out by tasters. The laboratory should not have pictures, paintings or any decorations that could distract the tasters' attention. It is recommended to paint the walls and equipment in white or soft pastel colors.

**Lighting parameters.** Light in the laboratory is necessary for work and to create a favorable environment. Sunlight is the most optimal for tasting. Since the level of light in the room varies

depending on seasonal and weather factors, it is desirable that the windows of the sensory laboratory face the north side, and the window area should be at least 35% of the floor area.

If the tasting room is not sufficiently supplied with sunlight, it is necessary to provide artificial lighting, preferably fluorescent lamps and "northern light" lamps. Lighting with incandescent lamps hides some disadvantages, for example, oxidation of fat, which is expressed in the yellowing of the product. Regarding the intensity of light, the opinions of experts differ, therefore the level of illumination is recommended in the range from 30-50 to 100-200 lux. In addition to general diffused lighting with lamps located evenly over the entire area of the tasting ceiling of the room. Individual lighting with an intensity of at least 500 lux must be provided at each workplace.

When evaluating products, it is also important to observe certain distances from the lamp to the sample (about 0.6 m) and the angle of incidence of the light flux. For example, meat products are recommended to be illuminated at an angle of 45°C, and their inspection should be carried out at an angle of 90°C, since the color is visible in the diffuse reflection and the gloss is an obstacle in the case of specular reflection at other angles. It is necessary to provide a composition of light that does not distort the natural color of the evaluated products.

In some cases, the lighting should hide visible differences in the product that can significantly affect the results of the tasters' work, which is achieved by using removable color filters. Thus, when tasting some food products, it is recommended to use green filters, for meat - red, and for drinks - orange or red. Sometimes, instead of light filters on individual lamps, tasters use glasses with replaceable light filters, while the tasting room is darkened.

**Sound insulation.** Organoleptic assessment, as a psychophysiological process, requires considerable tension and concentration from the tasters, so special attention is paid to the soundproofing of the room. In the usual organoleptic evaluation of products, which does not involve the analysis of auditory stimuli, noise regulation is a mandatory condition. If there is a telephone in

the tasting room, it should be turned off during organoleptic tests. Quiet, non-exciting music can be used as a calming factor during the work of tasters.

**Atmosphere parameters.** The tasting room must be isolated from extraneous odors that can distract the tasters' attention during the analysis. To avoid foreign odors entering the room, it is recommended to create a slight overpressure of air in the room. In the laboratory of organoleptic analysis, it is desirable to have a quartz lamp for rapid air deodorization or an ozone generator with a productivity of 10-20 μg/h.

Maintaining the temperature and humidity regime of the air in the laboratory is carried out with the help of an air conditioner. The recommended range of air temperature ranges from 18°C to 20°C, and relative humidity is within 45-70%.

**Requirements for dishes.** Samples must be served to tasters in absolutely uniform shape, color (white, transparent, creamy) and size dishes, as even minor deviations in this regard can affect the appearance of the sample. The dishes must be resistant to physical or chemical effects of the samples, have no smell and taste. In this regard, it is recommended to use dishes made of stainless steel, porcelain or glass. Wooden boards, spoons, spatulas, pins and other similar equipment easily perceive foreign smells. For tasting, it is better to use small forks and knives.

In order to maintain a constant temperature of the product during tasting, chemical glasses with electric heating, heating furnaces with controlled temperature, water baths, and hygienic insulating materials are used.

**Personnel.** The organization of the laboratory requires not only a specially prepared room, but also personnel that provide the necessary working conditions for tasters. The staff of the laboratory may be limited to one highly qualified specialist in sensory analysis and one to three laboratory assistants. These are persons who regularly carry out sensory evaluation of food products, who are not full-time tasters. They must often be distracted from the main work, spending a significant amount of the working day on it. In order to ensure smooth work, it is necessary for the tasters to officially draw

up contractual relations with the administration of the enterprise under which the sensory laboratory is located, and with their employer. This situation does not apply to students and to persons who are simultaneously involved in the consumer evaluation of food products.

Officials present in the tasting room must be dressed in specialized clothing. In addition to the tasters, there may be one more member of the technical team in the working process of the tasting room, who organizes the delivery of samples to the room and the removal of used dishes from it. Signaling is provided for the taster's communication with the technical group, in particular, the notification of readiness to evaluate the next product.

**Documentation.** The laboratory should have detailed records of the research results, indicating the date of the tasting, a list of members of the tasting commission, information about the samples, the presented evaluation list, etc. Documentation must be kept clearly and accurately. The laboratory must have reference literature, which includes standards and descriptions of the studied samples. The search for the necessary material and its accounting can be facilitated by creating a card file. Completed questionnaires are stored in the laboratory for a certain period of time.

**Computerization.** Summarizing the organoleptic evaluation of food products is related to the analysis and systematization of the results of the tasters' work, in connection with which computerization of the evaluation of the organoleptic properties of the sample is desirable. This saves labor and time spent on product analysis, which increases the reliability of the results obtained. The computer system mainly includes a data storage server, a main display, a printer and terminals for several organoleptics, portable workstations (Fig. 1.25). Tasters can enter the obtained results as they test the product.

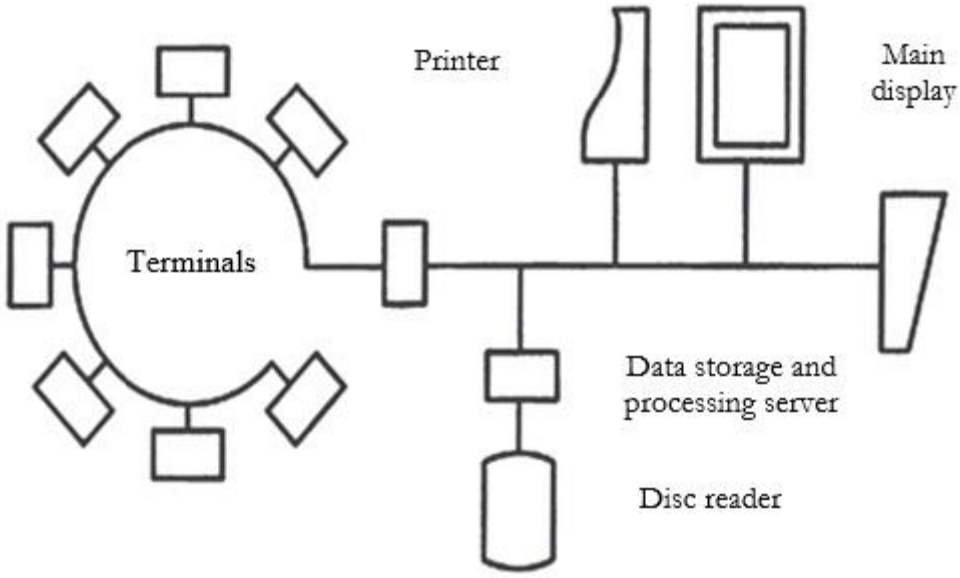



Fig. 1.25. The hardware part of the system of computer automation of organoleptic evaluation of food products

### 1.3.4. Electronic devices for sensory analysis

Intensification of the objectification of the sensory assessment of food products will allow us to get rid of the element of subjectivity in their assessment. Such objective sensor methods are analytical systems based on chemical sensors combined with complex computer algorithms for registration, processing and decision-making ("artificial intelligence"), for the study of multicomponent systems of variable composition, which allows identification of the components of food products in real time, without time-consuming sample selection and sample preparation operations.

The indisputable advantages of electronic sensor analyzers include their versatility, portability, the possibility of automation of measurements and signal interpretation, reproducibility of results. Research in the field of sensor systems is actively developing, and more and more scientists from different countries are publishing works on this topic.

**Sensor** –a primary device that responds to certain properties of the environment and allows recording this response in the form of a corresponding electrical (optical, etc.) signal. Chemical sensors provide information about the presence and concentration of various substances in these environments.

Chemical sensors used in multisensor systems can be grouped into four groups.

*Electrochemical* – these are potentiometric (ion-selective electrodes - ISE, ion-selective field-effect transistors - ISPT) and voltammetric sensors, electrolytic gas sensors, as well as semiconductor gas sensors.

*Optical sensors (optodes)* – in them, the definition follows optical spectra.

*Mass-sensitive sensors* include such devices that use surface acoustic waves (PAH sensors). In biosensors, the reaction is implemented: antibody - antigen, enzyme - substrate, receptor - hormone.

*The multisensory system* includes three levels: receptor (sensors), exchange and interpretation (artificial neural network). To date, multisensory systems for evaluating taste, color, and smell have been developed.

The impressive capabilities of natural biological sensor systems led to the idea of using the principles of their construction for the development of artificial sensor systems, first for the analysis of gases - in "electronic noses" (E-nose), and later for the creation of liquid analyzers - "electronic tongues".

### *«Electronic nose»*

The principle of detecting aroma-forming substances is widely used to create sensor devices that are intended for the analysis of food products.

**Aroma** – one of the main indicators of the quality of a food product, is formed with the participation of many volatile substances, each of which or a group of chemically similar compounds may not have the aroma typical for this product. Additional difficulties arise

when establishing the effect of individual odor components on the quality of a particular product.

We can only make assumptions about the role of this or that component. Thus, it can be assumed that sulfur-containing compounds, present in significant quantities in coffee, are of great importance for this product, or that heterocyclic compounds (pyrazine, pyrrole, furan derivatives), found in coffee, cocoa, bread and roasted nuts, have a fundamental value during the formation of the aroma of these products.

"Electronic nose" is a vapor analyzer based on a matrix of heterogeneous (unequal) sensors that imitates the human olfactory organ. The system provides an image of a specific mixture of vapors (odorous substances), which can contain hundreds of different chemical compounds. The basis of the "electronic nose" is a sensor matrix, which consists of gas sensors that are selected by chemical affinity to individual components of the analyzed mixture of gases and vapors. The picture of feedback from all sensors is quite complex. The identification and description of the smell in a generally accepted terminology that is understandable for humans is possible only with the use of modern electronic computing tools.

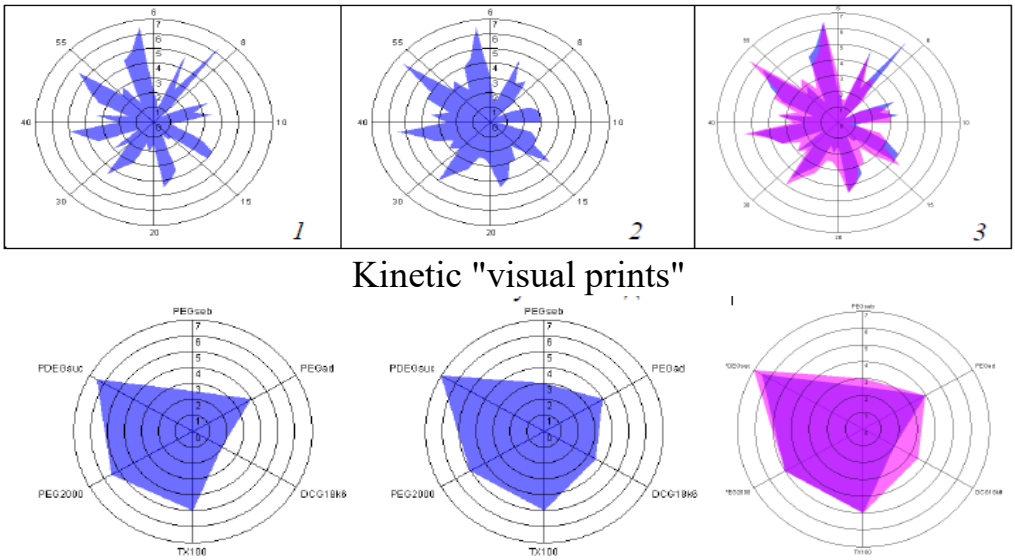
To create E-nose, various types of sensors are used according to the principle of operation: metal-oxide sensors, organic polymer, piezo-crystal sensors (quartz crystal microbalances), surface or volume acoustic waves, catalytic metal-oxide-silicon field-effect transistors, optical electronic sensors; therefore, the measured value can be: conductivity, mass gain, optical parameters, etc.

In the USA, Canada, Germany, gas analyzers with the E-nose methodology of the brands FOX, BEMINI, HERACLES, 4300 zNose GS/SAW, MOSES II, KAMINA, VOCmeter, etc. are produced and widely used for the express analysis of food products that work according to the principles given in table 1.6.

Unlike traditional sensor systems that require highly selective sensitive elements, electronic nose devices are a set of low-selective sensors of various types with cross-sensitivity.

Scientists created E-nose "MAG-8", which is an array of piezoelectric quartz sensors. A piezoelectric resonator with a film

coating on the electrodes was used as a working element in "MAG-8". The selectivity and sensitivity of such a device vary with the selection of the film coating - sorbent. The geometric parameters of the "visual impression" of the product aroma (shape and area of the figure) are determined by the qualitative and quantitative composition of the equilibrium gas phase above the samples. The area of the "visual imprint" reflects the total mass of volatile substances adsorbed by films during the measurement time, proportional to their concentration in the equilibrium gas phase (Fig. 1.26).




Kinetic "visual prints"

"Visual impressions" of maximum reviews

Fig. 1.26. Kinetic "visual impressions" and "visual impressions" of the maximum responses of piezo sensors of the "MAG-8" gas analyzer over walnut oil samples during storage (1) and (2), comparison of geometric parameters of "visual impressions" (3)

In Ukraine, as part of the complex scientific and technical program of the National Academy of Sciences of Ukraine "Sensor devices for medical, environmental and industrial-technological needs: metrological support and experimental operation" for 2013-2017, experimental samples of the analyzer based on amperometric enzyme biosensors for quality control and manufacturing of

beverages in winemaking were developed and an eight-channel gas analyzer sensor system of the "electronic nose" type based on a quartz microbalance and calixarenes, work on the development of their metrological support has begun.

Unlike traditional sensor systems that require highly selective sensing elements, the "electronic nose" uses a set of low-selective sensors. The possibility of implementing systems of the "electronic nose" type is based on advanced modern means of computing and methods of processing multiparametric information.

**Table 1.6. Classification of devices of the "Electronic nose" type**

| Sensor type | Principle measurement | Way production | Producer |
|---|---|---|---|
| Metal oxide | Conductance | Microelectronics | *Lennartz Electronics GmbH, Alpha MOS-Multy Organoleptic Systems, Nordic Sensor Thechnologies* |
| Conductive polymers | Conductance | Microprinting technology | *Alpha MOS-Multy Organoleptic Systems, Aroma scan PLC, Cyrano Science Inc.* |
| Piezocrystal personal microscale | Weight gain | Technologies application of microfilms | *HKR Sensorsystems GmbH, Alpha MOS-Multy Organoleptic Systems* |
| Superficial acoustic waves | Weight gain | Technologies application of microfilms | *Savtec Inc, Electronic Sensor Thechnology IEEV Ltd Chemical Sensor Systems* |
| Catalytic transistors | Measurement charge capacities | Microelectronic technologies | *Nordic Sensor Thechnologies* |
| Optoelectronic sensors | Fluorescence, IR spectrum, analysis of microfilm | Precise technologies, applying dyes | *Nordic Sensor Thechnologies* |

Nanotechnology makes it possible to expand the set of materials used for the production of sensors and obtain record characteristics. Among them are nanocomposite materials, which include nanoparticles of metals, metal oxides, and polymers. Nanocomposite materials are the basis of a new type of chemical sensors that have high sensitivity and selectivity, fast reversible adsorption response and work at room temperature. A set of nanocomposite materials with different chemical composition is one of the promising systems for creating an "Electronic Nose".

The "Electronic Nose" nanosensor neuro-like system includes the following components:

− a matrix of highly sensitive semiconductor sensors;

- gas phase composition analyzers. Sensors in the matrix must differ in their main parameters (sensitivity, selectivity), their number can vary from units to several dozen depending on the purpose and technical capabilities of signal processing. Polymer nanocomposites and nanostructured materials, which change their electrical conductivity differently under the influence of different substances, are supposed to be used as sensitive elements of the multisensor system;

- a sampling system for delivering a gas sample from the analyzed air volume to the sensor matrix. The sampling system includes a regeneration system designed to restore the functionality of the sensor matrix after exposure to active components of the air environment;

− analog adapter for maintaining the operating modes of the sensors in the matrix and converting the output signal of the sensors into a digital code;

- a digital controller for pre-processing the sensor signal and organizing a standard interface for communication with a computer;

- a computer with pattern recognition software.

The principle of operation of the device consists in measuring the electrical conductivity of the sensors during their interaction with vapors of volatile substances. As a result of the adsorption of the molecules of the substance under investigation, the electrical conductivity of the sensitive materials of the sensors increases. Each

sensor is not strictly selective for any gas. However, the response value of each sensor from the set to different gases must be individual. Mathematical processing of sensor array data allows to form a unique chemical image of the analyzed substance.

A sensor array usually includes from 8 to 30 elements. The unique image of the smell of the substance is formed due to the use of sensitive elements of sensors manufactured using nanotechnology.

Recognition of substances is carried out after "learning" the device. The device is trained as a result of recording the response of the sensor array when gas containing vapors of an individual substance is pumped through it. When vapors of various substances are sequentially pumped through the device, a library of responses is formed, which is stored in the memory of the computing device. Recognition is carried out by comparing the response from the analyzed gas with the responses from individual substances available in the response library. If a similar response or a combination of responses is found, the device gives a signal about the presence of vapors of a given substance or set of substances in the analyzed gas.

The main feature of this development is the use of a new generation of chemical sensors based on nano-heterogeneous thin-film composites. These materials combine the properties characteristic of nanoparticles with the properties of oxide sensors made according to planar technology.

Gas analyzers of the E-nose type have a wide range of uses: for quality assessment and screening of early spoilage of food products, objective quantitative assessment of the degree of odor expressiveness; assessment of the presence of synthetic flavorings, toxic substances; establishing the authenticity of samples; control of the technological process of production; evaluations of product aroma reproducibility from batch to batch; emission level of volatile substances from non-food matrices (plastic, packaging, paper, etc.).

The "Electronic Nose" nanosensor neuro-like system is designed for real-time detection of ultra-low concentrations of a wide class of substances, for example, for the analysis of odors of various substances, detection of vapors of toxic volatile organic compounds, explosives, drugs, etc.

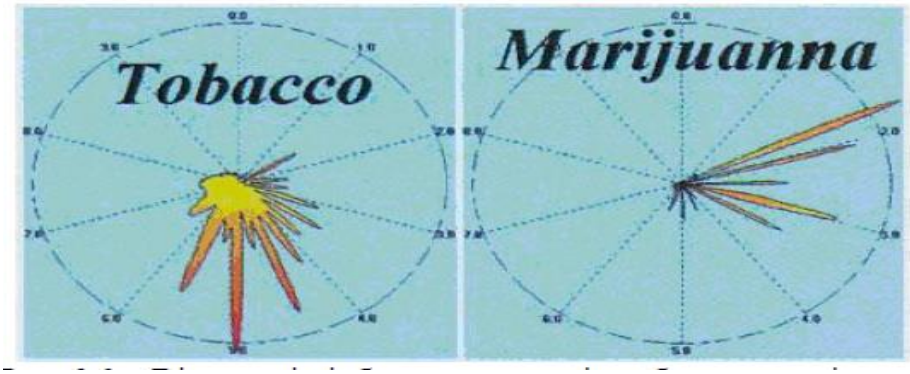


Fig. 1.27. "Visual imprints" of tobacco and marijuana aromas

Areas and projected shares of application of the "Electronic Nose" system:

- medicine (diagnosis of diseases based on the smell of breath and secretions, detection of pathogens of respiratory infections, determination of the level of alcohol and drugs in the blood, etc.);
- ecology (control of the state of the atmosphere, harmful emissions at industrial enterprises, exhaust gases of internal combustion engines, etc.);
- security (detection of explosives, poisons, drugs, early fire alarm systems, security alarm sensors, weapons of mass destruction detection systems, etc.);
- agriculture (determining the quality of agricultural products, production of animal feed, accelerated breeding, etc.);
- quality control, the first signs of spoilage and detection of falsification of products in the food, liquor, and tobacco industries;
− science (quick analysis of protein mixtures in genetic engineering, identification of plants and animals in biology, etc.);
- mechanical engineering (self-diagnosis systems of devices based on internal smells, sensors of industrial and consumer robotics, etc.);
- extractive industry (analysis of oil and gas vapors for the search and monitoring of deposits, quick identification of minerals, etc.);
- household appliances (consumer control, determining the degree of readiness of the product in stoves and microwave ovens,

robot vacuum cleaners and disinfectants, etc.).

### *«Electronic tongue»*

The organization of the functioning of the organs of taste is similar to the olfactory system, although the number of taste receptors in humans is much smaller than the number of olfactory receptors.

The same organizational principles (an array of low-selectivity sensors and multidimensional data processing methods) were applied during the development of multisensor systems for the analysis of liquids - "electronic tongues".

The "electronic tongue" system is an analytical device that includes an array (set) of chemical sensors with relatively low selectivity, which have sensitivity to several components of the analyzed solution at the same time (cross-sensitivity), and uses an appropriate multidimensional method of processing data received from the array of sensors, such as a pattern recognition or multidimensional calibration method. Such a system, when reproducing the analytical behavior of sensors and applying an adequate calibration method (graduation, training), is able to perform the functions of recognition (identification, classification) of various liquid environments and multicomponent quantitative analysis of inorganic and organic components.

The potentiometric method and voltammetry are used to detect the signal in "electronic tongue" systems. The essence of measurements with an array of potentiometric sensors is similar to work with individual ion-selective electrodes: the EMF of electrochemical cells is measured in succession, each of which includes one working sensor from the array and a reference electrode. Multi-channel voltmeters with high input resistance (at least $10^{12}$ Om) are used for measurements. As a rule, control of the measurement procedure and recording of data is carried out with the help of a computer.

Measurements using a voltammetric multi-sensor system are carried out according to a classic three-electrode scheme: a reference electrode, a steel auxiliary electrode and an array of working

electrodes, which are switched by a commutator.

Multi-sensor systems of the "electronic tongue" type can be used to solve a variety of analytical problems, both traditional for chemical sensors - quantitative analysis of solutions, and non-typical - recognition, identification and classification. The most common objects of analysis using "electronic tongues" are food products. The capabilities of the "electronic tongue" type system allow even such complex research as recognition and classification of wines of a certain type by age.

With the help of an "electronic tongue" type system, the possibilities of evaluating the taste characteristics of solutions of food products were investigated, for example, the taste, acidity and texture of coffee, the saturation of taste and aftertaste of ghee, "diet" (the degree of difference between regular and light versions of the drink) in "Pepsi-circle" etc.

The first multi-sensor systems, as well as many systems of the "electronic tongue" type, proposed to date, are based on the use of ion-selective electrodes or sensors close to them in terms of functioning.

The system was successfully applied to solve various tasks. "Electronic tongue" is used not only for recognition and identification, but also for multicomponent quantitative analysis. It can work in different environments. The "electronic tongue" system can be defined as an analytical device that includes a set of chemical sensors with a relatively small selectivity, which have sensitivity to several components of the investigated solution at the same time (cross-sensitivity), and use an appropriate multidimensional method of processing data obtained from an array of sensors, for example, a pattern recognition method or multivariate calibration. Such a system, with the reproduced analytical behavior of the sensors and the use, if necessary, of an adequate method of calibration (graduation) is able to perform the functions of recognition (identification, classification) of various liquid media and multicomponent quantitative analysis of inorganic and organic components.

Systems of the "electronic tongue" type can include various

chemical sensors for liquid analysis, regardless of the physical principle they work on (Fig. 1.28).

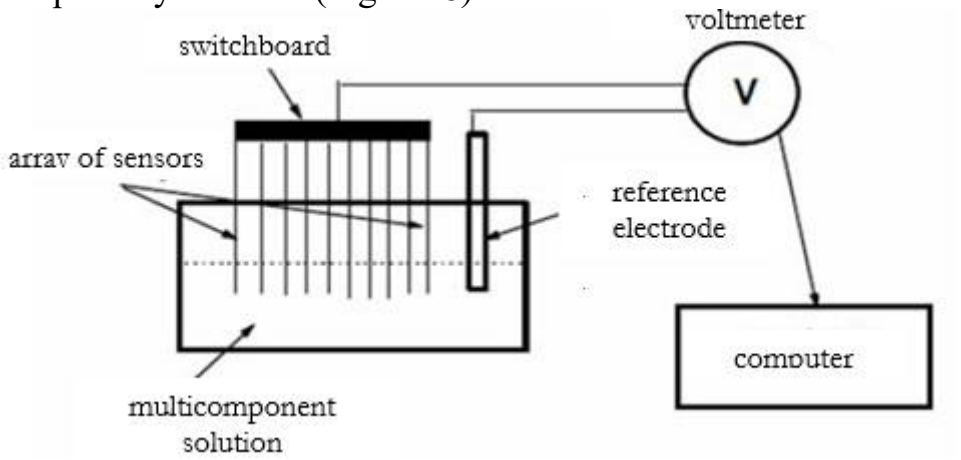



Fig. 1.28. Measuring scheme of the "electronic tongue" based on potentiometric sensors

The "electronic tongue" system can be defined as an analytical device that includes an array (set) of chemical sensors with relatively low selectivity, which have sensitivity to several components of the analyzed solution at the same time (cross-sensitivity), and which uses a suitable multidimensional method of processing data obtained from an array of sensors, such as pattern recognition or multidimensional calibration. Such a system, with the reproducible analytical behavior of the sensors and the application, if necessary, of an adequate calibration method (graduation, training) is capable of performing the functions of recognition (identification, classification) of various liquid media and multicomponent quantitative analysis of inorganic and organic components.

The system consists of a set of separate sensors (Fig. 1.29), which allows you to quickly change the composition of the array, making it flexible and precisely configured for a specific task. The array of sensors is immersed in a measuring cell (white cylinder) placed on a magnetic stirrer. The black device is an electronic system for measuring sensor signals, which combines a voltmeter with high input resistance, an ADC and a multiplexer. A personal computer is used to control the entire system and process data.

Fig. 1.29. Device "Electronic Tongue"

Various conductive polymers, such as polyaniline, polypyrrole, as well as stearic acid and their mixtures, are proposed to be used as sensor materials for the "electronic tongue". Langmuir-Blodgett polymer films are applied to a metal substrate. Measurements using the obtained electrodes are carried out by the method of electrical impedance spectroscopy. Complex resistance is measured at room temperature (20 ± 3) °C in the frequency range of 20-105 Hz.

If chemical sensors are the "heart" of any multi-sensor system, then the electronic "brain" of the system is another very important component of the "electronic language" - adequate methods of processing data from an array of sensors. The choice of a specific method of data processing depends on both the analytical task and the sensitivity parameters of the sensors.

***«Electronic eye»***

An optical multi-sensor system of the "electronic eye" type is created on the basis of digital video recording of volumetric effects of sorbent granules in the analyzed solution, equipped with a multidimensional data processing system. With the help of digital colorimetry methods, it is possible to identify and quantitatively analyze biologically active substances of food solutions and control

the color of colored products (water, milk and dairy products, vegetable oils, beer, etc.), using data on color reactions.

A spherical electronic image sensor developed by scientists from Illinois (Fig. 1.30) repeats the shape and performs all the functions of a healthy human eye. The new eyes work on the same principles as telescopes.

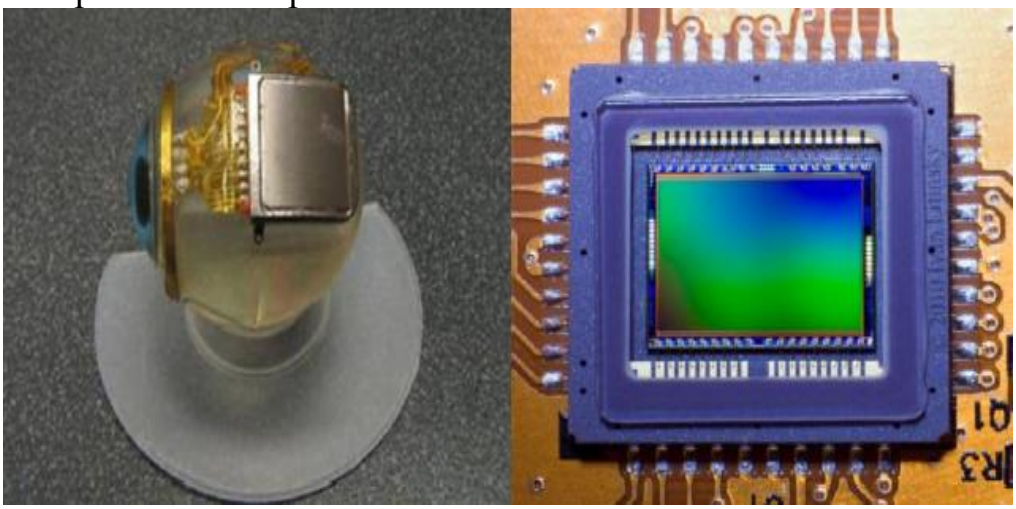


Fig. 1.30. Device "Electronic eye"

This structure provides a wide field of vision and high image quality. The matrices of spherical cameras have a curved shape, like a real eye.

Due to this structure, a single lens is enough to project the picture correctly. At the same time, matrices containing silicon elements are connected to a microcomputer and transmit images to the visual center of the brain. Sensor detectors convert light radiation into electrical impulses, which then reach the end of neurons. The sensors installed on the board imitate the retina of the human eye, and the lenses of the photo lens imitate the cornea.

This is not the first attempt to create a full-fledged substitute for vision, but no invention has previously repeated the simplicity, functions and shape of the organ. Electronic devices invented before this were built on a rigid circuit board that mimics the retina. At the same time, the sensor camera was fixed on the patient's head or on glasses, and the implanted chip transmitted the image to the optic nerve and directly to the brain. The developed retina is based on the

use of a flexible substrate capable of assuming a spherical shape. The new eye does not differ in any way from the real one.

Colorimeters developed in Japan (Fig. 1.31) can be used both independently and together with a personal computer and a data processing module, which is also a high-speed miniprinter.

Fig. 1.31. Colorimeters CR-400/410 (KONICA MINOLTA, Japan)

Colorimeters of the CR-400 series are self-contained portable devices that allow you to measure samples, compare samples with standards, display data on the display and store up to 1000 readings in memory. Features of the CR-400 series include a large backlit display, touch control, three-color colorimetry and color differences for 14 standard color scales.

The CR-400 series colorimeters can be used with the compact DP-400 data processor with a built-in printer suitable for printing graphs, or communicate directly with a personal computer.

**Questions for discussion and self-examination**

1. State the basic principle of operation of the "electronic nose" device.
2. What are the advantages of using electronic devices in sensory analysis?
3. State the disadvantages of using electronic devices in sensory analysis.
4. What is an aromatogram?

5. Specify the areas of use of electronic sensor analyzers.

6. On what principle does the "Electronic eye" device work?

7. What sensor materials are used for the "electronic tongue"?

8. Name the working principle of the colorimeter

9. What components does the "Electronic Nose" nanosensor neuro-like system include?

10. What characteristics are evaluated using an "electronic tongue" type system?

*Topic 1.4. The system of organizing and carrying out sensory analysis*

### 1.4.1. Sample selection

In order to obtain accurate and reliable numerical values of product quality indicators determined by the organoleptic method, both the qualification, skills and abilities of the evaluator, as well as the conditions for conducting the analysis, are necessary. Therefore, when organizing sensory analysis, it is necessary to take into account the rules of sampling, room requirements, sample preparation and tasting, as well as determining the sensory abilities of experts in different ways.

**Sampling** is carried out by specialists trained and authorized for this purpose in accordance with the current regulatory documentation for specific products and are responsible for the correctness of sampling. If it is necessary to send the samples to a laboratory located outside the place of their sampling, the samples are packed in a common container (box, bag, can), which is sealed with or without the number of the sampling protocol.

If the samples are intended for external tasting, for example, at the tasting board of the ministry, department or other organization that controls the quality of products, the selection of samples and samples of products is formalized by a relevant act.

With the current technological in-plant tasting control, the acts of sampling are not drawn up, and the protocol of the tasting meeting states:

- names of product samples;
- manufacturing workshop, production date;
- information on the regulatory documentation regulating the quality of the product, information on the commodity grade (or brand), the net weight of the sample, a brief description is given with an indication of laboratory quality indicators;
- the results of the tasting evaluation.

The departmental instruction sets the consumption norms of products and additional products for conducting tastings (bread,

sugar, mineral water, etc.) based on 1 taster. The consumption of goods is formalized by a corresponding act, which is signed by the chairman of the tasting committee and two members of the committee, approved by the head of the enterprise and submitted to the accounting department.

### 1.4.2. Conducting tests

Regulatory documentation is being developed for methods of determining the organoleptic indicators of products.

According to the general rules for conducting tests, organoleptic indicators are evaluated in a certain sequence: appearance, color, smell, consistency and taste:

1. Before the tasting, the samples are checked for good quality;

2. Products are tested under the conditions in which they are used or at the temperature specified in the regulatory documentation. For example, the temperature of products consumed hot should be from +55 to +60 °C.

There is evidence that the optimal temperature zone of the four main preferences does not coincide:

- the sweet taste is better perceived at a sample temperature of 37 °C, only at the level of 50 °C the sensitivity to this taste drops sharply;
- for salty samples, the optimal zone is around 18 °C;
- bitter taste is best felt at a temperature of 10 °C;
- some taste sensations disappear at 0 °C.

3. It is necessary to maintain the homogeneity of the external design and evaluation conditions for the samples as much as possible, so as not to cause tasters to have extraneous associations. For example, the shape of the sample should be the same, samples should be submitted in equal quantities, that is, unequal volumes or different shapes suggest that a larger volume corresponds to the best quality or vice versa;

4. During a closed tasting, the production packaging, label, and other information about the manufacturer, is removed from the

samples. Before submission, samples are coded with numbers or letters. Samples of one type of product are collected in series. The values are known only to the organizers of the tests. It is better to code with three-digit numbers, that is, the number 1 or the letter A compared to others makes a better impression. Two-digit ciphers can cause an association of symbols about the category, grade, type of products;

5. In the case of discriminating tests, the order of product tasting is established according to the degree of increase in the intensity of the smell or the number of seasonings or according to the increase in the mass fraction of the constituent elements (fat, salt, sugar, etc.):

- the procedure for submitting samples should be as diverse as possible and controlled. If a sample of a product is consistently offered first (or is duplicated in triangular tests), it may seem "different" or have more pronounced properties (salty, sweet, etc.). If samples are presented that differ sharply from each other (very good, or vice versa - bad), it is possible that the taster's judgment will be too harsh and the evaluation of another (worse) sample will be underestimated;

- before the start of the evaluation, they offer, as a rule, a standard sample, a sample of good quality;

- products with a weak smell are evaluated first, etc.;

- *when evaluating the quality of meat products* the following sequence is recommended: boiled sausages and baked products, then with moderate saltiness and aroma, then smoked, then heated products;

- *when assessing the quality of dairy products:* whole milk (milk, cream, fermented milk drinks, sour cream, cheese, semi-finished products depending on fat content, initially without additives);

– canned goods (dry, sterilized, concentrated);

- butter (sweet and sour, sour milk, cream) with filling, chocolate, salty, ghee);

– cheeses (fermented milk, soft, natural, rennet, salted, melted, low-fat);

- ice cream;

- *when evaluating the quality of fruit and vegetable products:* natural - snacks - marinades and salads - first courses - second courses - concentrated tomato products - sauces - vegetable juices - fruit and berry juices - sweet dishes;

6. The number of samples should be from 1 to 3 in one block. For visual assessment, up to six samples can be submitted in one block. This is due to the fact that an intensively expressed property causes rapid adaptation and, therefore, reduces the sensitivity of tasters.

Secondly, the uniformity of the samples also leads to a decrease in the "desire" to evaluate different quality characteristics.

Third, depending on the properties of the product, after 5-8 attempts, take a break of at least 15 minutes to restore sensory abilities.

### 1.4.3. Mode of operation of the tasting commission

The chairman or secretary of tasting commission determines the composition of the commission, which must correspond to the profile of the analyzed products, informs the members of the commission in advance about the range of products.

The practice of conducting tastings indicates the following optimal **operating mode of the commission**:

1. Formulation of the purpose, tasks, work order of the tasting commission (head or organizer of tests) - 15 minutes;

2. Work of tasters - 30 minutes;

3. Discussion of the results - 15 minutes.

The optimal time for the tasting is 10-11 hours, since the sensitivity of the evaluators is optimal. It is not advisable to conduct the tasting on an empty or full stomach.

Half an hour before the tests, tasters should not smoke, drink or eat. Changes in the positive evaluation of a food sample depending on the state of the evaluator's body are called alesthesia.

Such shifts from pleasant to unpleasant occur in relation to some tastes and smells of food after saturation. Shifts from unpleasant to pleasant to the same taste and smell components occur in the state of hunger. The state of hunger sharply increases the sensitivity to sweet, the level of preference for this taste increases, but in the state of satiety, the sensitivity decreases.

### 1.4.4. Results processing

Each member of the tasting committee writes down his opinion on the tasting sheet of the established sample and signs it. Erroneously recorded results are crossed out and signed by the taster.

The tasting sheet is then given to the secretary to process the results:

1. First, the evaluations of the tasters are averaged according to single indicators. The secretary enters into summary sheets the evaluations of all tasters for each sample and calculates the average arithmetic values of evaluations of single indices (in points) according to the formula:

$$\overline{X} = \frac{\sqrt{\sum_{i=1}^{n} x^2}}{n}, \qquad (1.1)$$

where $\sum_{i=1}^{n} x_i$ – the sum of the tasters' ratings for a specific indicator (taste, smell, etc.) of one product sample;

n – number of tasters.

2. To characterize the dispersion of the set of evaluations by tasters, the secretary calculates the standard deviation for each individual indicator using the following formula:

$$S=\sqrt{\frac{\sum_{i=1}^{n} x_i^2}{n}} - \overline{x^2}, \qquad (1.2)$$

where $\sum_{i=1}^{n} x_i^2$ - sum of squares of tasters' ratings, points;

$\overline{x^2}$ - the square of the average value of the indicator scores, points.

The standard deviation S characterizes the consistency of experts' opinions, provided the analyzed samples are homogenous.

For example, if the grades are unequivocal, then S on a 5-scoring scale usually does not exceed +0.5 points. With a deviation of +1.0 or more (this corresponds to a coefficient of variation of 20% or more on a 5-scoring scale), the analyzed set of assessments is statistically heterogeneous.

If no mistakes were made during the preparation of the samples or during the tasting, then the quality of the training of the tasters is called into question: professional and qualitative competence, sensory ability, objectivity. In this case, a re-check of the tasters' sensory sensitivity is carried out, and other quality indicators of the tasters are re-evaluated. The evaluations of the tasters who did not pass the retest are excluded from the analyzed set, which is statistically processed again.

3. The complex indicator Q is calculated according to the following formula:

$$Q=\sum_{i=1}^{n} \overline{x_i}, \qquad (1.3)$$

where $\overline{x_i}$ - averaged estimates of individual quality indicators (taste, smell, consistency, etc.), points.

4. Based on single and complex indicators, in accordance with regulatory documents, the quality level of the evaluated products is established.

The use of special devices for objective sensory assessment is allowed.

After conducting product tests and announcing an average rating or a single decision, they are discussed, during which conclusions about the products are made, and any recommendations are formulated.

Decisions of the tasting commission are formalized in protocols and other documents of the established standard depending on the tasks of the tasting analysis, and are communicated to the members of the commission and the applicant.

In the protocols of the tasting committee it is necessary to indicate:

- date and place of tasting;
- composition of participants;
- purpose of tasting;
- assortment and characteristics of the product (name, manufacturer, batch data, date of selection, etc.);
- quality characteristics and scoring of products (defects and positive qualities);
- adopted decision, recommendations, signatures of the chairman and secretary.

Protocols and other final documents have legal force when solving the relevant tasks of the tasting.

The cost of product samples submitted to the interdepartmental tasting commission, the organization of tasting analysis are charged to the enterprise (firm) or private applicant.

### 1.4.5. Tasting commissions

Tasting commissions of several levels are formed and function in the production area for the manufacturing of high-quality products and the formation of consumers' tastes.

The tasting commission can be created and approved at organizations, departments, firms for a period of no more than 2 years, it can have an interdepartmental nature. The work of the tasting committee is carried out in accordance with the Regulations

developed on the basis of current normative documents on the organoleptic evaluation of food products and food raw materials.

Depending on the purpose, the tasting commission is called upon to solve the following tasks:

- periodic quality control of food products produced at enterprises and firms;
- assessment of the quality of new types of food products in order to make a decision on supplying them for production;
- protection of the consumer's rights when purchasing substandard products, resolution of disputes arising between the consumer, the seller and a third party;
- unification of efforts of controlling organizations, higher educational institutions and scientific research institutes on methodological support of quality control of food products and food raw materials.

Meetings of the tasting commission are held in accordance with the annual work plan or outside the plan at the suggestion of the chairman. Meetings are convened by the chairman, and in his absence by the deputy chairman of the commission.

Meetings can be open or closed at the decision of the chairman. At a closed tasting, the products are encrypted by the secretary of the tasting committee or the organizer of the tasting, who does not participate in the tests.

Depending on the assortment of products, the purpose and tasks of the tasting, a working group of the tasting commission is created, which carries out the task of the tasting commission on the organoleptic evaluation of a specific type of product.

The composition of the working group of the tasting commission is determined by the head of the tasting commission or his deputy. It includes scientists, experts from similar groups of food products, specialists from control and public organizations, enterprises and firms of the food industry, trade and public catering, who have special experience in tasting work and the appropriate

qualification of a taster from the corresponding group of food products.

In cases where a member of the working group of the tasting commission is an interested person (product manufacturer, author of a normative document, etc.), he is granted the right of an advisory vote.

The tasting commission must include at least 5 expert tasters who have the individual ability to establish specific differences in color, taste, smell, aroma, and other organoleptic quality indicators.

The head and secretary of the tasting commission are chosen from among the most authoritative and professionally experienced specialists.

Taking into account the factor of subjectivity in the evaluation of organoleptic indicators, the taster is subject to high demands of ethics, self-education and training, professional skill and lifestyle. Only in this case, he can give an objective assessment of the product, possess information in the field of identification and examination of the appropriate range of domestic and imported products.

During the work of the taster, the influence of a bad mood, general fatigue, perfumes, colognes, deodorants, extraneous noise, conversations, etc., should be excluded. Tasting is not recommended close to breakfast, lunch or dinner. The taster should avoid states of hunger and satiety, refrain from smoking, eating and drinking half an hour before the tests.

*Rules and procedure for conducting tasting evaluation* of individual groups of food products are determined by relevant regulatory documents of other departments and organizations. All tastings, except for the working one, are held in specially equipped tasting rooms.

Let's consider in more detail the production tasting, which consists of several levels.

Selective control over the release of high-quality products is carried out by the Central Tasting Commission of the Ministry or

Department at least once a year. Also, this commission approves products of a new assortment, which is recommended for implementation at enterprises of the industry. Tasting commissions are formed mainly according to the position principle.

The tasting committee of the enterprise (production tasting), whose work is determined by the calendar approved by the head of the enterprise, performs the following functions:

- selective control of the quality of products manufactured by the enterprise;
- assessment of new types of products when introducing new equipment and technology;
- quality control of batches of products intended for export, exhibitions and competitions, as well as imported products;
- resolution of disputed issues in cases of complaints from buyers, traders and other organizations.

The meeting of the tasting commission is held every month. Based on the control results, an act is drawn up. In cases where defects are found, an explanation of the head of the technical control department and a plan of measures to eliminate the detected defects and the use of products with defects are attached to the act. The act is drawn up in 3 copies and sent to the management of the enterprise and to the higher organization (if there is one).

Every month, the company sends the organization information about the results of the evaluation of products and at the same time submits a certificate of the release of products of improved quality.

The decision of the company's tasting commission is recorded in the protocols of the meeting, which is the basis for the production of high-quality products. All types of in-plant documentation accompanying finished products for shipment are stamped with a QC stamp.

The composition of the production tasting commission is appointed by the head of the enterprise. The composition of such a

commission includes the chief engineer, the head of the technical control department, the chief technologist, and a sanitary doctor.

### 1.4.6. Types of tastings

Organoleptic analysis often pursues different goals, solves different tasks. One of the main tasks of tasting commissions is to control the quality of food products and educate consumers' tastes. Therefore, the organization of organoleptic analysis in each specific case requires taking into account its goals and tasks. Below is a brief description of the main types of tastings.

- *working* – is carried out directly in the production premises by technologists and employees of technochemical control laboratories. It is carried out systematically throughout the entire technological cycle of food production, allows to detect and prevent violations of technological parameters of production in advance, to predict the possibility of defects, to correctly determine the terms of technological processing of products;

- *production* – is carried out by a group of specialists of the given enterprise, association, when solving issues related to the evaluation of food products (preparation for the approval of new types, approval of recipes, selection of samples for the competition, etc.). For this purpose, a production tasting commission is created at each enterprise, which unites the most qualified specialists.

The work of the production tasting commission, like other commissions, must be carried out in a special room and be subject to special rules, which we will consider below.

Tasting commissions are:

- *expert or arbitration* – is carried out during the resolution of controversial issues on the quality of food products, a number of special tasks: determination of the conformity of one or another sample to a specific type of product, its evaluation at the request of controlling organizations, selection of samples for international competitions, etc.;

- *competitive* – is held at international, republican, thematic exhibitions and competitions in order to identify the best samples of food products;

- *commercial* – is carried out during wholesale purchases, international deliveries, buying and selling of food products. The main evaluators in this case are buyers;

- *educational* - makes it its task to train specialists in the basics of organoleptic analysis in the conditions of retraining or advanced training;

- *demonstrative* – is held for a circle of people who are interested in the quality of food products and their assortment. In the process of such a tasting, the consumer is introduced not only to the technique of its implementation, but also to the history of food products, the basics of their technology.

**Questions for discussion and self-examination**

1. Rules of sampling for tasting analysis.
2. What are the requirements for the room where sensory analysis of food products is carried out?
3. Describe the rules for conducting tests during organoleptic analysis.
4. Describe the mode of operation of tasting commissions.
5. How are the results of the tasting commissions processed?
6. What is a tasting commission?
7. What types of tasting do you know?
8. Sensory analysis laboratory: working room, individual place of the taster, lighting and atmosphere parameters, soundproofing.
9. Procedure for organizing the work of tasters: personnel, preparation and submission of samples, documentation, registration of results.
10. Rules and procedure for the tasting evaluation

*Topic 1.5. Requirements for expert tasters*

## 1.5.1. Selection of tasters

In our country, the work of a taster is not professional in the usual sense of the word. It is defined as one of the functions of a technologist, workshop foreman, laboratory assistant and other food industry specialists. The work of tasting commissions is strictly regulated by various organizational documents.

Organoleptic assessment is carried out exclusively with the help of the taster's senses. In some cases, depending on the type of product, the data of physical and chemical analysis are additionally used. Members of the tasting commissions acquire all the necessary knowledge and skills during practical work. Special training of tasters is not carried out. However, the work of a taster requires high qualification, attention, great psychological return and enthusiasm.

Of particular importance is the selection and certification of tasters based on their sensory abilities and other qualities. By developing and improving the organoleptic properties of food products, sensory knowledge (human cognition through taste, smell, color and other sensations) develops and improves. Many researchers equate the work of a taster with a measuring device, the accuracy and reliability of which are imperfect because they are affected by many factors.

Factors influencing the work of tasters:

- *subjective*

• individual features of the taster (characteristics of sensitivity and adaptation; features of perception: sensory dominants; feature of attention; feature of thinking; feature of memory);

• features of the taster's personality (motivation, expectations, comfort, influence of authority; cognitive activity; intra-extroversion);

• the state of the taster (hunger, thirst, health, emotional state);

- *objective*

• workplace of the taster (noise, smell, lighting, ventilation, humidity, temperature, color background of the room and furniture);

• peculiarities of food products (contrast of the samples; specific properties of the sample; position of the sample in the series; monotony of the properties of the series of samples);

• organization of the workplace (tasting load; accuracy of the instructions; dimension of the scale; procedure for submitting samples; additional incentives and information; form of discussion of evaluations).

To carry out qualitative organoleptic analysis, the selection of tasters follows their training. According to D.E. Tilgner, the first methods of selecting tasters appeared in 1932 in the USA. In 1945, the first private school to train tasters for a food company was established in Boston. At first, the tasters were selected based on taste and smell sensitivity.

In the interview with the subjects, their interests, experience, personality traits and education were determined. After that, the selected tasters were trained in specific methods of organoleptic analysis of the quality of food products.

In Great Britain, the sensory quality analysis has been discussed since 1955, after the change of the card system for food products. Currently, research in this area is coordinated by the British Institute for Standardization.

In France, methods of sensory quality analysis are being developed at the Institute of Biological Problems of Nutrition and the Food Industry at the University of Dijon.

In 1973, this institute developed and applied a method of selecting tasters, which included tests for: recognition of basic tastes, ten scents of essences; samples that are not repeated in the "triangle"; determination of the intensity of the taste of food samples and the intensity of lines on the surface.

Currently, many countries, in order to unify the methods of organoleptic analysis and quality assessment of food products, use the recommendations of the International Organization for Standardization to control the taste sensitivity of tasters (ISO-3972). They describe the conditions for measuring detection thresholds, recognition of four main preferences.

All methods are based on the principle of selecting tasters with increased sensory sensitivity, which is a professionally important quality of a taster. The concept of sensory minimum was introduced by D.E. Tilgner in 1957.

Sensory minimum is the high sensitivity of the taster's taste, smell, and color analyzers, high tactile sensitivity of the oral (mouth) surface, and high tactile sensitivity of the fingers.

The methods of selection of tasters in the world are engaged relatively recently. Thus, in 1972, the DAMW-VW 656 standard was developed in Germany, and in Hungary, in 1976, the sectoral methodology for selecting tasters of the sugar industry SZT 304/1T(175) was developed.

Finding tasters with a high level of sensory sensitivity is a challenge. Studies by R.V. Holovnia claim that in order to select 10 tasters with high sensitivity, which is set by the sensory minimum, it is necessary to examine 500 people.

In 1985, a joint document was developed for the countries of Eastern Europe, which provides a general approach to the selection of tasters. However, this document could not be used as a practical guide for the selection of tasters because:

- the main methodical feature is missing - criteria for evaluating individual results based on individual tests and the overall selection result;
- it does not allow to differentiate the level of suitability of the tasters who have passed the selection: the taster can be assigned to the class of very good or to the class of average level;
- the tests given are not the same in rigidity.

Feeling the properties of food products is a subjective reaction of the taster (evaluator). The perception of individual properties of the product occurs as a result of their impact on the receptors of the evaluator's sense organs (a receptor is a part of the sense organ that responds to individual stimuli).

Evaluation of organoleptic properties includes six stages:

1. perception
2. awareness
3. fixing

4. memorization
5. reproduction
6. actual assessment

*Psychological selection* – admitting people to a certain type of activity, taking into account the assessment of their abilities. Such abilities include: the sensitivity of the analyzer, attention, memory, mental, linguistic motives of behavior, attitude towards oneself, other people, sociability.

Abilities that ensure successful mastery of an activity are called *professionally important qualities* (abilities) (PE).

During the selection of tasters, uncompensated abilities of tasters and properties that can be useful in their activities are determined. *Uncompensated* properties of tasters include recognition and discrimination thresholds of taste, smell, color sensitivity, measure of reliability of the taster. *Properties useful in the activity of a taster* include: the volume of taste terms necessary for describing sensations; strength of conformal reactions.

The following diagnostic selection criteria do not depend on the taster's gender, age, experience of his work in the tasting commission, smoking factor without taking into account the specifics of the tasting commission.

Threshold values are measured in an environment of extreme success orientation. Success orientation is a strong criterion to which the taster's entire behavior is subjected. Therefore, in order to control and stabilize his behavior when measuring professionally important qualities,such techniques are introduced:

1. *Analyzer settings* - a change in the sensitivity of the analyzer under the influence of the subject's motivation depending on his skills in working with stimuli of a given range or depending on the degree of awareness, comprehensibility of the instructions, etc. This procedure provides an opportunity to get acquainted with the specifics of solving the problem, to develop a plan for the sequence of actions. All this reduces the influence of random interference and selection results, increases the reproducibility and reliability of the results.

2. Instruction before solving problems. The requirements for the instructions are as follows:

- *comprehensibility* - its text is available for subjects to understand the purpose and methods of problem solving;
- *independence* - ensures the independence of solving tasks;
- *unambiguity* - ensures unequivocal behavior of subjects in case of doubt.

3. Limited time for solving problems. The need to introduce this technique stems from the requirements for the taster to develop a certain speed when solving selection tasks. For example, a condition is set that the taster must solve the task in 20-30 minutes.

In addition to these disorders, psychological studies have revealed the phenomenon of incorrect use of the adjectives "salty", "sour" and "bitter". The most common mistakes occur when a person has to name “sour”, this word is often confused with the “bitter” and “salty”. Such violations occur quite often and can range from 25-35% of the examined persons. These errors disappear after subjects are taught the standards, although the learning outcome changes over time. When studying this phenomenon, solutions with a distinct salty, sour, bitter, sweet taste are used.

Disorders of smell

*Anosmia* - lack of olfactory sensitivity to all odorous substances, or to one substance, or to a group of substances.

*Hyperosmia* is an extremely high olfactory sensitivity to all odorous substances, or to one substance, or to a group of substances.

*Hyposmia* - reduced olfactory sensitivity to all odorous substances, or to one substance, or to a group of substances.

*Parosmia* - a perverted ability to smell, which is not characteristic of a given substance or group of substances.

Clinical color vision disorders of tasters include **daltonism** - complete or partial color blindness (agnosia).

When preparing samples tested for taste and smell, they are prepared in distilled water.

The following chemicals are used to prepare solutions that express the main tastes: sodium chloride - salty solution, tartaric acid - sour solution, sucrose - sweet solution, quinine hydrochloride - bitter solution.

The following chemicals are used to prepare solutions expressing the main smells: rectified ethanol - the smell of alcohol, acetic acid - the smell of vinegar, mint - the smell of mint, thymol - the smell of thymol.

The presence or absence of color blindness is checked, usually, with the help of specially developed polychromatic tables. Polychromatic tables of E.B. Rabkin are used in domestic medical clinical studies (1962). You can familiarize yourself with the basic terms in the field of determining the abilities of tasters and the methods of selecting tasters based on uncompensated indicators in laboratory classes.

### 1.5.2. Assessment of the volume of the taster's vocabulary

The volume of the taster's vocabulary is the number of specific words that the taster knows and uses when describing the taste of the product being evaluated by the time of selection.

The essence of the experiment: the taster must carefully monitor the taste sensations that arise when evaluating the quality of 10 different samples by product name. It can be 10 samples of different juices or 10 samples that correspond to the specifics of the taster's work.

All subjects taking this test must evaluate identical sets of 10 samples of different names. The individual index of the volume of the dictionary is taken to be the arithmetic mean of non-matching words used by the taster to describe the taste property. Answers are recorded on the survey card.

Experts found that employees of main enterprises have a larger arsenal of vocabulary words than employees of district enterprises. This is explained by the fact that the former face a large range of

products. At the same time, the level of education does not affect the volume of the taster's vocabulary, as does the gender of the taster.

It is impossible to standardize this technique because the assessment of the volume of the taste vocabulary is situational: its volume is determined by the specific type of food products used, the experience of the taster and the tasting committee at the time of the study.

The final stage of the selection of tasters (after determining the uncompensated abilities and properties useful for his/her activity) is **the calculation of the integral assessment of the taster's competence**.

The numerical value of the taster's competence is calculated as the sum of the levels of all measured professionally important qualities during the selection and is denoted by the letter K.

To obtain diagnostic estimates, a distribution curve of a part of K values measured in 100 subjects is constructed, and extrapolation is carried out using the moving average method, and then quartile K values are calculated, that is, K values that occur in 25, 50, 75, 100% of subjects. These values are marked from 4 to 1 point, respectively. High competence corresponds to the number 4, low to 1. Table 1.7 shows the diagnostic values of K calculated according to this scheme.

**Table 1.7. Diagnostic values of competence (K) of tasters**

| Diagnostic values *K* | Level assessment *K* |
|---|---|
| more 59 | 4th level (excellent) |
| 59-38 | 3rd level (good) |
| 37-28 | 2nd level (satisfactory) |
| 27-17 | 1st level (bad) |

Tasters with the 4th, 3rd and 2nd levels of competence are given the right to a decisive vote when working in the tasting

commission. Tasters with the 1st level of competence acquire the right of an advisory vote.

Tasters with a decisive vote can solve any tasks related to the organoleptic evaluation of the quality of food products. The most difficult tasks should be solved by tasters with the 4th and 3rd levels of competence.

Tasters with an advisory vote receive the right to be present at the meetings of the tasting commission in order to get acquainted with the conditions of its work, to obtain information about the quality of the evaluated products. These tasters may conduct product tests, but their evaluations shall not be taken into account when calculating the average values of the quality evaluations of the food products tasted by the commission.

The tasters who have passed the selection and have the competence coefficients calculated are issued a taster's diploma (certificate).

### 1.5.3. Improving the qualification of tasters

After the selection, tasters are not yet prepared to analyze the quality of food products. The training and education of tasters is aimed not only at improving the abilities of tasters as a measuring device, but also at developing the ability of tasters to improve and simulate the organoleptic properties of food products.

According to many researchers, it is necessary to train selected tasters. There are different types of training:

- general – aimed at improving the taster's sensitivity;
- specific – training in the peculiarities of organoleptic analysis of the food products quality, study of research methods and forecasting consumer ratings.

*Training of analyzers*. Training of taste and smell sensitivity, as well as color functions is carried out constantly. Research is also being conducted into the possibility of using biostimulants in the development of the aforementioned functions (in particular, E.B. Rabkin used tinctures of ginseng and Chinese lemongrass in his training. Currently, methods of training tasters of the fish and wine

industries have been developed, but they are urgently needed by the brewery, canning, dairy and meat processing industries.

*Learning the taste vocabulary.* The need to develop such vocabularies is huge, since the evaluation tables of GOST obviously lack the terms that characterize the specifics of the organoleptic properties of food products.

Existence of precise, unambiguous terminology is extremely important, as it makes it possible to:

- increase the accuracy of organoleptic evaluations given by tasters of food products, using expressions characterizing all possible organoleptic features;
- improve the mutual understanding of specialists.

There is a need for the personnel responsible for the various stages of production (from the receiver of the raw product, foreman, etc. to laboratory workers, technology) to use the same unambiguous terms.

*Training programs for tasters.* In some Western countries, the selection and training of tasters is carried out in universities for the training of food technologists.

Thus, in the Gdańsk Polytechnic Institute, from the 7th to the 9th semester, students study according to D.E. Tilgner, which gives skills necessary for sensory minimum. If it is not fulfilled, then the future fate of the student as a specialist is determined.

The training program includes the following 7 classes:

1). Identification of 4 main preferences;

2). Odor identification – recognition of odors in normal products and in products with defects and their correct identification;

3). Special training of excellent taste sensitivity on aqueous solutions of 4 basic tastes and food samples, the taste of which is specially simulated by the addition of salt, sugar, acid and bitterness. The training is considered completed if the student correctly identified the salty sample in 6 triangles;

4). Memory for taste (training with different concentrations, both weak and intense);

5). Paired comparison with standards - development of memory of taste, smell and concentration of attention;

6). Ranking of differences is a training of memory, sensitivity and concentration of attention of students;

7). Compensation of the organoleptic property is the selection of a smell or taste capable of masking or emphasizing the effect of the taste, aroma of the control sample.

*Study of consumer ratings*. Consumer ratings are studied for various purposes: studying the acceptability and preference of products; study of satisfaction with food products; development of organoleptic properties of the sample; studying the perspective of consumption, etc. By studying consumer evaluations, the company's tasting committee, through advertising, should disseminate information that helps shape the style, taste, and consumption trends of food products.

When choosing food products, consumer behavior is influenced by many factors that are difficult to measure quantitatively. What is preferred is not always bought. If the preference can be influenced by superstitions, religious principles, habits, etc., then the acceptability of the food product varies depending on the social and cultural standard of living of the consumer. A phenomenon opposite to preference is *aversion* - rejection of a food product due to subjective feelings, unpleasantness of its organoleptic properties. *Food taboo* is a food prohibition related to religious beliefs, superstitions, medical indications. When studying preferences (aversions, taboos) of acceptability, questionnaires are conducted. Such questionnaires reflect the characteristics of the consumer and the food product being studied.

## Questions for discussion and self-examination

1. What factors affect the taster's work?
2. The history of the development of selecting tasters method.
3. Write the disadvantages of the three main tests of tasters.
4. How is selection based on uncompensated indicators carried out?
5. How is the selection of tasters based on properties useful in professional activity?
6. Improving the qualification of tasters.

7. Write the individual characteristics of tasters.
8. Methodology and stages of training of professional tasters.
9. Program for the selection of persons suitable for the training of tasters.
10. How are tasters trained?

# CHAPTER 2. RESEARCH OF SENSORY PROPERTIES OF RAW MATERIALS, MEAT, FISH AND INVERTEBRATE PRODUCTS

Determination of organoleptic quality indicators of food products depends on the objectives of the research. The evaluation of the quality of raw materials and production batches of meat and fish products according to organoleptic indicators is carried out strictly in accordance with valid state standards or regulatory documentation, which reflects the requirements for the nomenclature of indicators and contains test methods. But when performing sensory studies, as a rule, there is a need for a more differentiated assessment of organoleptic indicators than is regulated by the documents for production batches of meat and fish products.

The material presented in this section can serve as a methodical guide in the study of sensory properties of raw materials and products from meat, fish and invertebrates and comparison of the obtained results with the requirements of current regulatory and technical documentation.

## *Topic 2.1. Methods of determining the organoleptic parameters of raw materials and meat products*

The most common organoleptic method is the scoring method, which involves the use of logical and mathematical analysis. This method makes it possible to systematize the variety of feelings, describe each quality indicator verbally and evaluate it with a certain numerical value that corresponds to a certain score.

### 2.1.1. Evaluation of organoleptic indicators of meat of slaughter animals

Raw materials (meat of slaughtered animals and poultry) according to organoleptic indicators must meet the requirements listed in table 2.1.

**Table 2.1. A characteristic feature of meat**

| Characteristic | Characteristic features of meat or offal | | |
|---|---|---|---|
| | fresh | of questionable freshness | stale |
| 1 | 2 | 3 | 4 |
| The appearance and color of the carcass surface | It has a dry pale pink or pale red crust; thawed carcasses are red in color, the fat is soft, partially colored in a bright red color | Moistened in places, slightly sticky, darkened | Very dry, grayish-brown mucus is present on the surface of the carcass, mold is possible |
| Condition of the muscles on the section | The muscles are slightly wet, the filter paper - without the remains of a wet spot from the muscles; have a characteristic color for this type of meat: for beef - from light red to dark red, for pork - from light pink to red, for lamb - from red to red-cherry, for lamb - pink | The muscles are wet, the filter paper has a wet spot from the muscles, a little sticky, and has a dark red color. Somewhat cloudy meat juice flows from the cut surface of thawed meat | Wet, filter paper contains a damp muscle stain; the muscles are sticky to the touch, have a red-brown color. Cloudy meat juice flows from the cut surface of thawed meat |
| Consistence | On the cut, the meat is dense, springy; when pressed with a finger, a dimple is formed, which quickly disappears, leveling off | On the cut, the meat is not dense enough, not elastic enough; the hole formed when pressed with a finger flattens out slowly (within 1 min), fat is soft, thawed meat is slightly fluffed | The meat is limp when cut; the hole formed when pressed with a finger does not align, the fat is soft, in thawed meat it is loose, salted |

**Continuation of table 2.1**

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Scent | Each type of fresh meat has its own specific smell | A somewhat sour smell, may have a musty shade | Slightly putrid, or sour, or musty |
| Fat condition | Beef fat is white, or yellow, or yellowish; solid consistency, fresh fat tends to crumble when crushed; pork fat has a white or pale pink color; has elasticity, soft to the touch; mutton has a white color and a dense consistency. Fat should not have a rancid smell | The color of the fat is grayish-matte, slightly sticky to the fingers; the smell may be somewhat rancid | The color of the fat has a grayish-matte shade, the fat smears if it is crushed with your fingers; a small amount of mold is possible on pork fat, the fat may have a rancid smell |
| Tendon condition | The tendons are elastic, dense, the surface of the joints is smooth, brilliant In thawed meat, the tendons are soft, loose, and have a bright red color | The tendons are less dense, matte white in color. Joint surfaces are slightly covered with mucus | Tendons are softened, grayish in color. Articular surfaces are covered with mucus |
| The transparency and aroma of the broth | Transparent, fragrant | Clear or cloudy, has an unusual smell fresh broth | Turbid, with a lot of flakes with a sharp, unpleasant smell |

The methodology for evaluating the organoleptic parameters of meat and meat products applies to beef, mutton, pork and meat of other types of slaughter animals, to pulp offal.

Currently, the three-point hedonic scale for determining the degree of freshness of meat laid down in regulatory documentation is widely used, according to which:

• 3 points correspond to excellent quality - the meat product is fresh;

• 2 points correspond to satisfactory quality - a meat product of questionable freshness;

• 1 point corresponds to poor quality - the meat product is stale.

Sampling is carried out as follows: meat samples weighing at least 200 g are taken as a whole piece from each meat carcass being examined, or from its part, from the following places:

• in the cervical notch, against the 4th and 5th cervical vertebrae;

• in the area of the scapula;

• in the thigh from thick parts of the muscles.

Samples from frozen and chilled blocks of meat and offal, as well as from individual blocks of suspicious freshness are taken as a whole piece weighing at least 200 g. Each sample taken separately, before sending to the laboratory, is packed in parchment paper, marked with a simple pencil with the name of the fabric, internal organ, carcass number. A sample from each carcass is packed in a paper bag and placed in a metal box, which is closed, sealed, sealed. A document is attached to the samples selected and prepared for sending to the laboratory, in which the date and place of selection, the type of meat, the number of the carcass, the reasons and objectives of the study, the name (with signature) of the sender must be recorded.

Organoleptic methods are used to determine the following indicators at an ambient air temperature of 15-20 °C and natural lighting: the appearance and color of the muscles of the carcass; consistency; scent; fat status; tendon condition; clarity and aroma of the broth. Each selected sample is analyzed separately.

The degree of freshness of meat can be investigated by a chemical method, by reaction with copper sulfate.

*Determining the freshness of frozen meat during refrigerated storage.* Storage of meat at sub-zero temperatures is accompanied by the development of oxidative processes that lead to changes in heme pigments and the accumulation of fat oxidation products. The change in the lipid

fraction during long-term storage of meat is also associated with their hydrolytic breakdown under the action of fibrous enzymes.

For research, a meat sample weighing at least 200 g is taken from the half carcass (a whole piece from the longest back muscle within the ninth-twelfth rib). When analyzing lard, the surface layer of lard is included in the sample.

To determine the color, the selected samples are placed in polyethylene bags and thawed in a stream of tap water for 2 hours. When determining the content of fatty acids and peroxides, frozen samples are kept in a glass vessel at room temperature not higher than 30°C, then crushed and analyzed.

*The appearance and color of the meat of the carcass* is determined by external inspection, visually under natural lighting. They pay attention to the condition of the surface of the meat, its color, the drying of the skin. A fresh cut of the muscle tissue is made on the meat and the color and condition of the muscles are determined in the deep layers, the stickiness of the muscle tissue is determined by palpation, and the moistening of the surface of the meat on the cut is determined by applying a piece of filter paper to the fresh cut. At the same time, they note the presence of blood residues, dirt, mold, etc.

*Determination of consistency* is carried out as follows. A hole is formed on a fresh cut of the carcass or the tested sample with a light pressure of the finger and the rate of disappearance (recovery) of the formed hole is observed, setting the time for its alignment.

*The smell of the surface layer of the carcass* or the tested sample is determined by the organoleptic method. First, the smell of the surface layer of the studied samples is determined, and then the meat on the cut. Make an incision with a clean knife and immediately determine the smell in the deep layers. When examining the carcass or its part, special attention is paid to the smell of the layers of muscle tissue adjacent to the bones. For a more complete characterization, the smell of the examined meat is determined by the "cooking" sample.

*The state of fat* is determined in the carcass at the time of sampling, the appearance, color, smell and consistency of fat are

determined. Small pieces of fat are rubbed between the fingers, thereby establishing the consistency of the fat and its smell.

*The condition of the tendons* is determined in the carcass at the time of sampling. By palpating the tendons, their elasticity, strength and condition of the articular surfaces are determined. The color and appearance of the tendons are assessed visually under natural lighting.

*Determination of the transparency and aroma of the broth* is carried out as follows.

Preparation for tests: to obtain a homogeneous sample, each sample is passed separately through a meat grinder with a diameter of 2 mm mesh holes, the minced meat is thoroughly mixed. Weigh 20 g of the obtained minced meat on a laboratory balance with an error of no more than 0.2 g and place it in a conical flask with a capacity of 100 ml (cm3), fill with distilled water in the amount of 60 ml (cm3); after that, it is necessary to mix thoroughly, and, covering with a watch glass, boil for 10 minutes. in a water bath.

Conducting tests: the smell of meat broth is determined in the process of heating to 80-85 °C at the moment of the appearance of vapors that come out of the soaked flask.

To determine the transparency, 20 $cm^3$ of the broth is poured into a measuring cylinder with a capacity of 25 cm3 with a diameter of 20 mm and the degree of its transparency is visually determined.

Based on the results of the tests, a conclusion is made about the freshness of the meat or offal according to the characteristic features listed in Table 2.2.

**Table 2.2. A characteristic feature of offal**

| Indicator | Characteristics of offal | | |
|---|---|---|---|
| | fresh | of questionable freshness | stale |
| 1 | 2 | 3 | 4 |
| Liver, kidneys, brain, spleen Appearance and surface color | Clean, shiny, without damage to the shell, slightly moist; evenly colored; the color is characteristic of this species offal: liver - from light brown to dark brown; kidney - from light brown to dark brown; brain - from light pink to dark pink; spleen - red, with lilac or purple shades | Moist, dull, slightly sticky; unevenly colored; color: liver - brown or light brown with the presence of gray areas; kidney - brown or light brown with the presence of gray areas; brain - light gray; spleen - grayish-red with lilac or purple shades | Moist, dull, slightly sticky; unevenly colored; color: liver - light brown with greenish shade; kidney - light brown with a greenish tint; brain - light gray with a yellowish tint; spleen - gray-red |
| Sectional view | The surface is slightly wet; does not leave a wet spot on the filter paper | The surface is wet; leaves a wet spot on the filter paper | The surface is wet, sticky; leaves a wet spot on the filter paper |
| Consistence | Elastic; the hole formed when pressed with a finger is quickly leveled | Less elastic; the hole formed when pressed with a finger is leveled within a minute | Fluffy; the dimple that is formed when a finger is pressed on the surface remains without leveling |
| Scent | Inherent in fresh, benign offal, specific for these products | Slight musty, fast-evaporating, acidic or ammoniacal odor | An unpleasant rotten smell, not typical of fresh offal |
| The transparency and smell of the broth | The broth is transparent, the smell is characteristic fresh benign offal | The broth is slightly cloudy, with a faint taste musty, sour or ammoniacal smell | The broth is cloudy, with a lot of it flakes, with a rotten smell |

Meat or by-products classified as of questionable freshness by at least one sign are subjected to chemical and microbiological analyses.

### 2.1.2. Assessment of organoleptic indicators of poultry meat

Poultry meat - whole and semi-full carcasses and their parts: chickens, ducks, geese, turkeys, guinea fowls, quails, broiler chickens, ducklings, goslings.

*Definition of smell.* Unpackaged frozen carcasses or their parts are thawed at room temperature until a temperature of 0 to 4 °C is reached in the thickness of the muscles with a depth of at least 5 mm.

Defrosting of poultry carcasses or their parts in a consumer container is carried out in water at a temperature of (30 ± 2) °C for 2-3 hours or at room temperature until the temperature in the muscle layer with a depth of at least 5 mm from 0 to 4 °C is reached. The water is constantly stirred. After thawing, the samples are removed from the consumer packaging and analyzed.

The smell of the surface of the carcass and the thoracoabdominal cavity or its parts is determined by the organoleptic method directly during sampling.

To determine the smell in the depth of the muscles, they are cut using a clean knife. It should be remembered that, first of all, the smell of a fresh cut of muscle tissue, which is adjacent to the bones, is examined.

The results of the analysis are evaluated for each carcass or part of the carcass separately and compared with the requirements of the regulatory or technical document for a specific type of poultry meat (Table 2.3).

**Table 2.3. Characteristic features of poultry meat according to organoleptic indicators**

| Name indicator | Characteristics of meat | | |
|---|---|---|---|
| | fresh | of questionable freshness | stale |
| 1 | 2 | 3 | 4 |
| Appearance and color: | | | |
| surface of the carcass | Whitish-yellow color, has a pink tint; lean carcasses have a yellowish-gray color and a reddish tint; lean carcasses have a gray color and a bluish tint | Stickiness under the wings, in the groin and in the folds of the skin; whitish-yellow color with a gray tint | Covered with mucus, especially under the wings, in the groin and in the folds of the skin; whitish-yellow with a gray tint, places with dark or green spots |
| subcutaneous and internal adipose tissue | The color is pale yellow or yellow | Pale yellow or yellow | Pale yellow, the inner surface has a yellowish-white color with a gray tint |
| serous membrane, thoracoabdominal cavity | Moist, shiny, without slime and mold | Without shine, sticky, the presence of a small amount of slime and mold is possible | Covered with slime, the presence of mold is possible |
| muscles in section | A little wet, filter paper - without a wet spot from applying meat to it; the muscles of chickens and turkeys are pale pink, ducks and geese are red | Wet, a wet spot remains on the filter paper, somewhat sticky, darker in color than fresh carcasses | Wet, on the filter paper - a wet spot from the meat, the muscles are sticky and have a darker color than the muscles of fresh carcasses |
| consistence | Muscles are tight, elastic; if you press your finger on the muscle, the formed pit is quickly leveled | Muscles are less dense and less elastic, when pressed with a finger, the formed pit is leveled slowly (within one minute) | The muscles are flabby, when pressed with a finger, the formed pit does not align |

**Continuation of Table 2.3**

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| scent | Specific, characteristic of fresh poultry meat | Rotten in the thoracoabdominal cavity | Putrefactive from the surface of the carcass and inside the muscles, most pronounced in the thoracoabdominal cavity |
| the transparency and aroma of the broth | Transparent, fragrant | Transparent, can be cloudy, have a slight unpleasantness scent | Cloudy, contains a large number of flakes, has a sharp unpleasant smell |

*Determining the transparency and aroma of the broth* in case of discrepancies in the assessment of the quality of poultry meat. From the sample (carcass or its part), except for the wings and neck, cut 70 g of muscle with a scalpel to the entire depth of the muscle tissue and, without mixing them according to the samples, grind them twice on a meat grinder.

Minced meat obtained from each sample is thoroughly mixed, then weighed. The wing and neck are not crushed.

To prepare meat broth, 20 g of minced meat, weighed with a deviation of ± 0.1 g, are placed in a conical flask with a capacity of 100 cm3 and filled with 60 cm3 of distilled water. The contents of the flask are thoroughly mixed, covered with glass, boiled in a water bath for 10 minutes.

The aroma of meat broth is determined in the process of heating to a temperature of 80-85 °C by the aroma of vapors coming out of the soaked flask.

The degree of transparency of the broth is established visually by inspecting 20 cm3 of broth poured into a measuring cylinder.

The results of the analysis are compared with the requirements given in table 2.3.

*Determining the consistency and condition of muscles* on a cut of poultry meat. With a finger, lightly press on the surface of a part of the bird's carcass or on the surface of the carcass in the place of the pectoral and hip muscles, forming a pit, and observe its alignment.

The pectoral and hip muscles are cut across the muscle fibers.

Muscle moisture is determined by applying filter paper to the surface of the muscle section for 2 seconds.

Muscle stickiness can be determined by touching the surface of the cut muscle with a finger.

The results of the analysis are compared with the requirements of table 2.3.

*The degree of exsanguination* is determined by visual inspection.

*Determination of the appearance and color* of the surface of the carcass, subcutaneous and internal adipose tissue, serous membrane of the thoracoabdominal cavity. The appearance and color of the surface of the carcass or part of the carcass, subcutaneous and internal adipose tissue, serous membrane of the thoracoabdominal cavity are determined visually on a sample selected and prepared in accordance with regulatory documentation.

The results of the analysis are compared with the requirements of the regulatory documentation for a specific type of poultry meat, listed in Table 2.3.

*Determination of the shape of the carcass* is carried out on a sample selected according to the current documentation. The carcasses are placed with their backs on a flat surface, if necessary, they are taken in their hands and rotated, determining the compliance of the form with the requirements of regulatory documentation for a specific type of poultry meat.

Determination of fattening of the carcass (the state of the muscular system and the presence of subcutaneous fat deposits) is carried out on a sample selected and prepared in accordance with the current documentation. When determining the development of the muscular system, special attention is paid to the degree of convexity

of the sternum and its covering by muscles, it is determined visually and by palpation of the entire carcass.

The subcutaneous fat deposits are determined visually. The results are compared with the requirements of regulatory documents for a specific type of poultry meat.

*Determination of the condition and appearance of the skin*. The condition and appearance of the skin is determined visually on the sample. The length of breaks on the skin of the poultry carcass is measured with a metal ruler with a division value of 1.0 mm or another measuring tool with similar metrological characteristics.

The measurement results are compared with the requirements of regulatory documentation for a specific type of poultry meat.

*The degree of feather removal* is carried out visually on the sample by counting the number of feather residues on the carcass. The results of the calculation are compared with the requirements of the regulatory documentation for a specific type of poultry meat.

*Determination of the state of the bone system* in carcasses (presence of fractures, deformations) is carried out on samples selected and prepared in accordance with the current regulatory documentation visually and tactiely.

*Determining the temperature of poultry meat*. The measuring instrument is a thermometer with a measurement range from minus 35 ºC to plus 45 °C, the limit of permissible error is ± 0.5 °C, with a scale division price of 1 °C.

It is allowed to use other measuring devices with metrological characteristics not lower than those specified in the standard and recommended for food products.

The use of mercury thermometers is not allowed.

Measurements are carried out directly during sampling.

The sensor of the measuring device is inserted into the thickness of the carcass or parts of the carcass. In frozen carcasses or parts of carcasses, a hole for the sensor of the measuring device is pre-made.

The results of each measurement are compared with the requirements of regulatory documentation for a specific type of poultry meat.

*Determining the mass of poultry meat*. Measuring tools - scales for static weighing with the largest weighing limit of 3 kg, with a division price of 5 g or others with similar characteristics.

Each carcass or packaging unit is weighed separately and the data is compared with the requirements of regulatory documentation for a specific type of poultry meat.

### 2.1.3. Requirements for tasting meat products

Tasting is carried out open or closed (blind).

The purpose of a closed tasting is to eliminate biased judgment or psychological influence on tasting participants.

The opinion about any food product largely depends on familiarity with its composition and method of preparation.

During tastings of products of current production, the indicators of technical conditions or standards for finished products should be reflected in the tasting sheet or magazine.

When evaluating new samples, one cannot approach from the standpoint of conservative habits and tastes. It is necessary to develop taste, to learn to understand unusual, different tastes, to get used to them.

After the tasting, an exchange of opinions can be organized, during which comments, conclusions and suggestions are presented that go beyond the parameters of the tasting letter and were not reflected in it.

When tasting meat products, the degree of pronounced taste, aroma and their thermal state are taken into account and presented in a certain sequence.

The color, type and pattern on the section, structure, distribution of ingredients are determined on the transverse and longitudinal sections of the finished product.

To determine the smell (aroma), taste, juiciness, the products are cut into pieces, tasting is carried out, while determining the degree of pronounced salty, sweet, sour, bitter taste, the degree of pronounced spice aroma, smoking, absence or presence of extraneous smell and/or taste, aftertaste .

By pressing, cutting, chewing, and smearing (pâtés), the consistency is determined at the end, establishing the density, looseness, tenderness, hardness, fragility, elasticity, uniformity of the mass (for pâtés).

Quality indicators of meat products are determined on the whole and cut product.

Organoleptic indicators are determined in the following sequence: appearance, consistency, cross-section, smell and taste.

First of all, food products with a weak aroma (less salty) are presented for evaluation, then with a moderately pronounced aroma, and finally - with a strongly pronounced aroma (salty, spicy, smoked). The taster evaluates the product consistently according to individual quality indicators according to the descriptive characteristics.

Also, the products are first tasted in a cooled state, and then in a heated state.

The tasting evaluation of the **entire product** is carried out in the following sequence:

- appearance, color and condition of the surface;
- smell on the surface;
- smell in the depth of the product - by inserting a wooden or metal needle;
- consistency - by pressing the product with a finger or spatula.

When determining the quality of the **cut product**, the following indicators are important:

- appearance;
- stickiness and sliminess;
- deformation of sausage loaves;
- color;
- smell and taste.

Basic requirements for tasters who carry out organoleptic evaluation of food products:

- no perfume;
- no smoking;
- no chronic diseases;
- perform sanitation of the oral cavity;

- men are prohibited from having beards and mustaches;
- good knowledge of production technology and standard requirements for finished products.

During the tasting, tea without sugar is used to neutralize the taste buds of the oral cavity. It is allowed to chew stale wheat bread. Mineral water, vegetable and fruit juices are prohibited.

### 2.1.4. Determination of organoleptic assessment of meat quality

Organoleptic evaluation of meat quality is carried out after its heat treatment. At the same time as the evaluation of the cooked meat, the quality of the broth is determined. Meat weighing 1 kg is placed in cold water (ratio 1:3), covered with a lid and cooked until fully cooked over low heat (within 1-1.5 hours) until the temperature in the center of the piece is (75±5) ºC; 30 minutes before the end of cooking, add table salt in the amount of 1% to the mass of meat. After the end of cooking, the meat is cooled to a temperature of 35-40 ºC, cut into slices weighing at least 50 g and the quality is evaluated according to the following indicators: appearance, consistency (tenderness, hardness), smell (aroma), taste, juiciness. To determine the quality indicators of the broth, it is poured into a glass beaker (diameter 50 cm3) and the appearance, color, smell (aroma), taste, richness (saturation with nitrogenous extractive substances) are determined.

After the organoleptic evaluation of 7-8 samples, a break is made for at least 10 minutes.

Organoleptic evaluation is carried out by using point system or a descriptive method. When evaluating quality indicators in points, only whole numbers are used. The use of fractional numbers is not allowed.

### 2.1.5. Organoleptic assessment of sausage products and characteristics of indicators

The assessment of the quality of finished sausage products is based on the results of determining organoleptic indicators. To determine the organoleptic parameters of the selected product samples, two point samples are taken from different units of the

product weighing 400-500 g and a combined sample weighing 800-1000 g is made. The samples are cut from the product in the transverse direction at a distance of at least 5 cm from the edge.

Point samples of sausages are taken in the form of whole units of products, the combined sample should have a mass of 400-500 g.

Single samples are cut from products in bubbles in the form of segments weighing 200-250 g, which make up two combined samples weighing 400-500 g.

At least three spot samples weighing 200-250 g are taken from meat loaves, and two combined samples weighing 600-700 g are made.

Selected combined samples for organoleptic tests are packed, each separately, in cellulose film, parchment or other materials allowed for these purposes by health authorities.

Before carrying out the organoleptic analysis of sausage products, they are freed from consumer packaging, twine or clips, casing, cut perpendicular to the surface of the product into thin slices with a sharp knife, so as not to change the appearance and pattern characteristic of the given product.

To determine the depth of penetration of mold under the shell, a sausage loaf is cut with a sharp knife in the place of mold and its depth is noted.

The appearance, smell of the outer surface of the shell, the surface of the loaf without the shell is determined after removing the shell from one half of the loaf. Determine the condition of the shell, minced meat and lard in the surface and central parts of the loaf.

Depending on the shape and thickness of the sausage loaf, the cut is different. It is necessary to cut the correct thin slices in compliance with the rules of hygiene.

In order for the slices to have an even plane of cut, the loaf must lie in such a position that the sharp cut angle is turned towards you, and the blunt one - away from you.

Sausage loaves and rolls with a large diameter are to be cut lengthwise, placing the flat part on a board and cut into slices for tasting. In this position, the loaf lies steady, it is easy to cut, and the slices come out of moderate size (half a circle). The length of a slice

cut from any loaf, as a rule, should be about 8 cm. The slice should correspond to the completeness of the sausage pattern, i.e., its appearance and grade.

Sausage loaves thick in diameter are cut at a right angle (90°) to the surface of the cutting board - direct cutting; thin loaves - at an acute angle depending on the thickness of the loaf to obtain a wider slice. The position on the board changes depending on the angle of the cut.

At a thickness (diameter) of 50-70 mm, the cutting angle will be 45-60°, and at 30 mm - 25-30°.

When tasting a product cut into slices, especially raw smoked sausages, the taste sensations, appearance and color depend on the thickness of the slices, so they should be the same. The thickness of the slices depends on the type and density of the sausage and is adjusted during the slicing process with the thumb of the left hand. Boiled and stuffed sausages are cut with a thickness of 3-4 mm, semi-smoked - 2-3 mm, hard-smoked - 1.5-2 mm, liver sausages with a spreadable consistency - 5 mm, and elastic consistency - 3 mm. Cut the liver sausage of a greasy consistency with one movement of the knife away from you. Liver sausages are cut with a narrow knife, as the minced meat of these sausages sticks to the wide plane of the knife and spoils the appearance of the slices.

Special gastronomic knives are used for cutting sausage products, the design of which takes into account the weight of the knife, the size and shape of the handle, the shape of the canvas, its length, thickness, and width.

The length of the blade of the knife should correspond not only to the width of the cut products, but also to the length of the knife during cutting. The length of the stroke of the knife is usually 2-2.5 times greater than the width of the product.

A very wide and thick knife makes cutting difficult, as the force of friction increases. The narrower and thinner the knife, the easier it is for them to work.

For cutting thin sausage loaves, special knives with a blade length of 250 mm are recommended, and for cutting thick sausage

loaves - knives with a blade length of 300 mm, for cutting ham, knives with a blade length of 300 and 400 mm are used.

*Processing products with bones for slicing*. After inspecting the appearance, bones and tendons are removed from all products and cut into slices 2-3 mm thick.

For manual slicing of the back bone, take it by the thigh with the left hand. The bone marrow is placed on the rib to prevent crumpling and separation of the fatty part, which happens when the bone marrow lies on the board with the skin down.

First, the pelvic bone is removed, if there is one, then the side part is cut along the femur. Then the bone is removed and the ham is cut crosswise rather than along the bone.

The scapula is cut in the same way as the periosteum, holding the handle with the left hand. After the lateral part is cut to the bone (cartilage), it is removed. The part is placed with the skin down and cut across - from the upper part to the shoulder joint. Then the humerus is removed and cut to the end, that is, to the elbow joint (forearm knuckle).

The loin and brisket are cut parallel to the ribs, without removing the skin. The loin is placed on a board with the skin on top. If you lay it with the skin down, it is more difficult to cut it. When the knife hits the rib of the loin, it is directed slightly to the side - bypassing the bone. When slicing 2-4 slices from the meat lying above the first half of the rib, the knife is directed to the right, and when slicing the meat above the second half of the rib, to the left. Thus, the rib is cut from two sides.

Bones from these products can also be removed using a metal wire with rings. Pre-slit each rib on both sides, put a string on the end of the rib, pull it tight, and the rib separates cleanly and easily.

The pork neck is cut into slices at an angle of 90° (straight cut). Fillets are cut (based on width) at an angle of 45-60°. Smoked-boiled flat-bone meat from the tibia is cut in half lengthwise and cut into slices at a right angle. Rolls of all types of large diameter are cut lengthwise, and then cut crosswise into slices at a right angle.

*Preparation for machine cutting of pork products. Posterior periosteum.* The treatment of ostus consists of the following consecutive operations:

- cleaning (removal of surface contamination); removal of the pelvic bone (if present);

- removal of the hip up to the knee joint; femur removal; removal of the kneecap and the rest of the pelvic bone; removing the skin from the bone.

All these operations are performed on a board with the help of a knife and a metal wire 3-4 mm thick, 40 cm long, in the form of an elongated awl with a bifurcated end.

The femur is removed from the tibia and tibia with a short, narrow knife. A knife with a long blade, which is used to cut ham, is not acceptable for this operation. The knee joint is felt with the fingers, then the skin and the entire suprabony layer of muscle tissue are cut around the bone with a knife at the level of the joint. The thigh cut in this way is folded and after cutting the connective tissue (tendons) it is easily separated. To remove the bone, a chisel or a string is used, which is passed through a needle with a slot along the bone. The middle of the metal wire is draped over the bone under the upper joint. The string, thus tucked in, is drawn back by the ringed ends, and the bone is separated without any meat remaining. It remains to remove the already separated bone from the bone, but its thick (articular) end prevents this. Next, the peribony layer of meat is cut for the free passage of the bone (this cut simultaneously serves for the passage of the metal wire that separates the bone).

The patella and the rest of the pelvic bone (the latter is not the case in all bones) are cut out in two or three steps with a small knife. The skin is removed only from boiled and smoked-boiled bones. The skin is removed by hand, that is, removed with a "stocking". The skin, which is firmly held, is trimmed with a knife. The periosteum separated in this way should be sliced by machine.

*Front periosteum.* The process of disassembling the front bone consists of the following operations:

- separation of the bones of the forearm together with the adjacent meat and tendons (removal of the leg);

- removal of the scapular bone and suprascapular cartilage;
- removal of the humerus;
- removal of skin from the front periosteum (scapula).

When tasting several bones, rolls or comparative evaluation, slices from the same anatomical parts should be presented to the tasters so that each participant of the tasting receives samples with the same morphological structure.

The ham should be cut into slices, and then into sectors. At the same time, a more uniform distribution of fat and muscle slices, as well as parts with different degrees of cooking, is achieved.

To better preserve the color and aroma of products cut into slices, to reduce their drying after slicing, the slices are placed on a dish in stacks or parallel rows, in each of which the slices are slightly offset from each other.

The quality of lard, as well as lard in products, for example, in ham, briskets and others, is checked by "cooking test" - boiling in water. At the same time, lard should not turn yellow.

To taste the toasted ham, slices should be placed on the pan one on top of the other, partially shifted so that the muscle tissue of the upper slice lies on the fatty tissue of the lower slice.

When frying the slices placed in this way, the muscle tissue loses less moisture than when placing the slices directly in the pan, the concentration of salts in it rises significantly less, the ham turns out to be juicier.

Quality is determined both on the whole and on the cut product.

When determining the quality of the **entire product**, important indicators are determined as follows:

- *appearance, color and condition of the surface* - determined visually by external inspection;

- *smell (aroma)* - determined on the surface of the product. To determine the smell in the depth of the product, a special wooden or metal needle is used, which is inserted into the thickness, then it is quickly pulled out and the smell of the layers of muscle tissue adjacent to the bone is determined in products that, according to the technology, are produced with bone;

- *consistency* - determined by pressing with fingers or spatula.

When determining the quality of the **cut product**, the following indicators are important:

- *appearance,* begin with an inspection of the surface of the products. At the same time, pay attention to the cleanliness of the surface, intensity of color, dryness or moisture, the presence of dirt, mold and slime on the surface of the products;

- *stickiness and sliminess* additionally determined by touching the product with fingers;

- note the deformation of the loaves, their contamination with fat, soot, the presence of lumps, cavities, swelling of fat and broth under the shell and its wrinkling. Therefore, sausage products are cut along the loaf. Half of the sausage loaf is freed from the casing and the uniformity of the distribution of ingredients, the shape and size of pieces of lard, the presence and type of minced meat are evaluated;

- smoked sausages are checked for possible compaction of the outer layer of minced meat;

- a cut containing fat and muscle tissue is made from salted products, and its condition is assessed;

- the smell and taste of the products are evaluated depending on their type at a temperature of 15-20 °C or heated. The smell of sausage products is determined immediately after cutting the loaf;

- the assessment of color, structure, distribution of ingredients is determined visually on a freshly made cut, longitudinal and transverse, of sausages, meat loaves, sausages, jellied meats and on a cross-section of products made from pork, lamb, poultry and other types of slaughtered animals.

When evaluating the color, pay attention to the intensity and uniformity of coloring of the surface of products, minced meat or meat tissues, note the presence of gray spots and yellow fat on the surface of the product cut.

The smell, taste and juiciness of sausages are determined after they are immersed in boiling water and heated to a temperature of 60...70 °C in the center of the product. The juiciness of sausages in their natural casing is determined by piercing them. A drop of liquid should appear at the puncture site.

**TASTING LETTER**

Surname and initials _____ Tasting date «_____» _____ 20___ yr.

Position

_____

(is filled out for representatives of third-party organizations)

Organization

_____

(is filled out for representatives of third-party organizations)

| № according to the order of presentation for tasting | Product name | Evaluation of products according to the 5-point system | | | | | | | Other remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | Appearance | Color | Smell, aroma | Consistence | Taste | Succulence | Overall assessment | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | | | | | | |
| | | | | | | | | | |

Signature _____

**Note:**

1. The tasting list is compiled and stored in the technological department; the storage period during the production of the assortment of product items is specified in the tasting sheet, and may be extended for reference purposes.

2. The composition of the tasting committee is appointed by order of the director of the enterprise. A member of the tasting commission must refuse the tasting in the presence of colds, manifestations of allergies and somatic manifestations accompanied by a loss of sensitivity to organoleptic indicators.

3. The evaluation is carried out according to a five-point system: 5 – excellent quality; 4 – good; 3 – satisfactory; 2 – bad; 1 – very bad.

**Protocols of the tasting commission**

city Hlobyne «_____»

_____ 20____ p.

The members of the tasting commission

_____

_____

_____

Invited persons

_____

_____

_____

(organization, position, surname, first name)

The following products were presented for tasting:

| Product name | Reasons for presenting to the tasting |
|---|---|
| 1 | 2 |
| | |

Conclusions of the tasting committee:

| Product name | Conclusions, including decisions regarding production planning |
|---|---|
| 1 | 2 |
| | |

Secretary of the tasting commission _____ Full name

The smell of sausage can best be determined if you break the loaf and immediately smell it. The emergence of a large surface and evaporation from it at the moment of formation makes it possible to catch even a weak smell, which is especially important in the presence of defects.

The results of the tasting evaluation are displayed in the tasting journal, the form of which is given below.

Sausage products according to organoleptic indicators must meet the requirements of standards for groups of sausages, which are listed in the Appendix (tables 2.4 - 2.11).

**Table 2.4. Organoleptic indicators of boiled sausages, sausages, meat loaves**

| Indicator | Characteristic |
|---|---|
| 1 | 2 |
| Appearance | Loaves of boiled sausages, loaves of sausages with a clean, dry surface without damage to the shell, influxes of minced meat, lumps, broth and fat swellings. Meat loaves with an evenly fried surface |
| Consistence | Elastic for sausages and meatloaves; tender, juicy for sausages and springy, juicy for bockwursts. Juiciness of sausages and bockwursts is determined when hot |
| Cutaway view of minced meat | Sausage products with a uniform structure - pink or light pink minced meat evenly mixed without cavities and gray spots, in products with liver - light gray or gray. In cooked sausages of the second and third grades with a uniform structure, the presence of small particles of connective tissue and spices is possible. Sausage products with a non-uniform structure - pink or light pink minced meat with pieces of fat of white color or with a pale pink |

**Continuation of Table 2.4**

| | |
|---|---|
| | shade, raw fat of beef or lamb, tongue, brisket, pork, beef, etc. On the cut of sausages of the first, second and third grades with non-uniform structure, meat loaves of the first and second grades are allowed to have single pieces of lard with a yellowish tint without signs of salting.<br>On the cut of sausage products, the presence of poor porosity is possible |
| Smell and taste | Characteristic of this type of product, with the aroma of spices, moderately salty, without extraneous smell and taste |
| The shape, size and trademark (knitting) of the loaves | For cooked sausages - straight or bent loaves from 15 cm to 60 cm long, in bellies - unscrewed half rings or rings with an inner diameter of no more than 25 cm.<br>For sausages - bars up to 14 cm long, with a diameter from 14 mm to 32 mm, for bockwursts - bars up to 11 cm long, with a diameter from 32 mm to 44 mm.<br>For meat loaves - rectangular, in the form of a trapezoid or other shape weighing no more than 3 kg. Boiled sausages, meat loaves of each name have a personal trade mark. For cooked sausages in natural and artificial unmarked casings — with transverse ties at the ends, in the middle of the loaf; in blind guts - along the entire length after 5-10 cm; in bubbles - oval-shaped, cross-tied; for meat loaves, the trade mark is determined on the surface by a capital letter of the name of the loaves |

**Table 2.5. Organoleptic indicators of boiled-smoked sausages**

| Indicator | Characteristic and norm |
|---|---|
| Appearance | The surface of the loaves is clean, dry, without stains, adhesions, damage to the shell and influx of minced meat |
| Consistence | Dense |
| Cutaway view of minced meat | Minced meat is evenly mixed from pink to dark red in color, without gray spots and cavities, and contains pieces of certain sizes of pork or brisket, or lard, or mutton fat, etc. A deviation in the size of individual pieces is allowed on the cross-section along the diagonal |
| Taste and smell | The taste is pleasant, slightly spicy, moderately salty, with a pronounced aroma of spices and smoking, with or without the smell of garlic, without extraneous aftertaste and smell |
| Shape and size of loaves | Loaves are straight or slightly bent, from 15 cm to 50 cm long |
| Trade marking (knitting) of loaves | Specific for each of the sausages of a certain name |

**Table 2.6. Organoleptic parameters of semi-smoked sausages**

| Indicator | Characteristic and norm |
|---|---|
| Appearance | The surface of the loaves is clean, dry, without stains, adhesions, damage to the shell and influx of minced meat |
| Consistence | Flexible |
| Cutaway view of minced meat | The minced meat is evenly mixed from pink to dark red in color, without gray spots and cavities, and contains pieces of lard, pork, brisket, beef or lamb fat. A deviation in the size of individual pieces is allowed on the cross-section along the diagonal |
| Taste and smell | The taste is pleasant, slightly spicy, moderately salty, with a pronounced aroma of spices and smoking, with or without the smell of garlic, without extraneous aftertaste and smell |
| Shape and size of loaves | Loaves are straight or slightly bent with a length from 15 cm to 50 cm, in the bellies - untwisted bars with a length from 15 cm to 35 cm or in the form of a ring or half-ring with an inner diameter from 6 cm to 25 cm |
| Trade marking (knitting) of loaves | Specific for each of the sausages of a certain name |

**Table 2.7. Organoleptic indicators of raw-smoked and raw-cured sausages**

| Indicator | Characteristics and norm for sausage | |
|---|---|---|
| | raw smoked | dried |
| Appearance | The surface of the loaves is clean, dry, without stains, adhesions, damage to the shell and influx of minced meat, damage to the shell or without a shell in the case of the use of decorations (coarsely ground spices) on the surface of the loaf.<br>May contain a white coating of salt on the surface of the shell | |
| Consistence | solid | dense |
| Cutaway view of minced meat | The minced meat is evenly mixed from pink to dark red in color, without gray spots and cavities, and contains pieces of lard, pork, brisket, crude fat, etc. There may be a deviation in the size of separate pieces on a diagonal cut; the presence of a compacted outer layer (hardening) of no more than 3 mm | |
| Taste and smell | The taste is pleasant, slightly spicy, salty, with a pronounced aroma of spices and smoking, without extraneous aftertaste and smell | The taste is pleasant, spicy, (slightly acidic is allowed), with a pronounced aroma of spices and drying, without extraneous aftertaste and smell |
| Shape and size of loaves | Oval, rectangular, trapezoidal or shaped in section, etc.; straight loaves with a length of 15 cm to 50 cm, in the bellies - untwisted loaves with a length of 12 cm to 25 cm or in the form of a ring or half-ring with an inner diameter of 8 cm to 20 cm | |
| Trade marking (knitting) of loaves | Specific for each of the sausages of a certain name | |

**Table 2.8. Organoleptic indicators of cooked, smoked and cooked beef and pork products**

<table>
<tr><td rowspan="2">Indicator</td><td colspan="7">Characteristic</td></tr>
<tr><td>Beef tongue smoked and boiled in high-grade lard</td><td>The brisket stuffed with the highest, first grade, smoked and boiled</td><td>Ham from beef and pork of the highest, first grades, boiled, smoked-boiled</td><td>Beef ham with lard of the highest grade, cooked, smoked and cooked</td><td>Roll made of beef and pork of the highest grade, smoked and cooked</td><td colspan="2">Beef roll with high-grade lard, smoked-cooked</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td colspan="2">7</td></tr>
<tr><td rowspan="3">Appearance</td><td colspan="7">The surface of the loaves is clean, dry, intact, treated with decorative materials (if they are used)</td></tr>
<tr><td rowspan="2">In a shell, tied with twine (threads, with a loop for hanging</td><td rowspan="2">With or without particles of red or black pepper and garlic, with or without a net, tied with twine (threads), with a loop for hanging</td><td rowspan="2">With or without sheath, tied with twine (threads) lengthwise and every (15-17) cm across or without binding, with or without loop for hanging</td><td colspan="3">In a shell, tied with twine (threads) along both sides and each</td></tr>
<tr><td>5 cm</td><td>15 cm</td></tr>
<tr><td>Form</td><td>Rounded, elongated</td><td>Oval-elongated</td><td>Cylindrical, in shape - cylindrical, oval, rectangular or other shape</td><td colspan="3">Round, cylindrical</td></tr>
<tr><td>Consistence</td><td colspan="2">Dense</td><td colspan="5">Flexible</td></tr>
</table>

**Continuation of Table 2.8**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Cutaway view of minced meat | The muscle tissue is pinkish-red, without gray spots, with a layer of fat that is white or with a light pink tint | Light pink muscle tissue, without gray spots, with layers of fat tissue of white color or with a light pink shade, in the center - evenly mixed pink minced meat with or without pieces of lard or meat (according to the recipe) | Muscle tissue is light pink in color, without gray spots, with layers of fat (lard) of pork white color or with a light pink shade and fat of beef white color or with a cream shade | The muscle tissue is pinkish-red in color, without cipyx spots with the inclusion of fat in white color or with a light pink tint |
| Taste and smell | The smell is pleasant, with the aroma of spices, garlic (if used), the taste is salty, without extraneous aftertaste and smell | | | |
| Note. Requirements for beef and pork products with their own names (if available) in terms of appearance, shape, cut appearance, smell and taste are specified in the technological instructions for the standard, approved in accordance with the established procedure | | | | |

**Table 2.9 a. Organoleptic indicators of pork products: boiled, smoked-cooked, smoked-baked, baked, fried, raw smoked**

<table>
<tr><td rowspan="3">Indicator</td><td colspan="8">Characteristic</td></tr>
<tr><td colspan="2">Boiled, smoked-boiled, high-grade bone marrow. smoked and baked. raw smoked</td><td rowspan="2">Roll of the highest grade boiled, smoked-boiled, smoked-baked. raw-smoked from the hip or scapular part, sterno-costal and neck parts</td><td rowspan="2">Roll made of high-quality piglets, boiled</td><td rowspan="2">Roll from the back-rib part sausages Higher variety boiled</td><td rowspan="2">Top-grade boiled, baked, fried ham</td><td rowspan="2">Carbonade of the highest grade boiled, baked, fried</td></tr>
<tr><td>from the pelvic-femoral part</td><td>from the scapular part</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td rowspan="3">Appearance</td><td colspan="8">The surface is clean, dry, intact, treated with decorative materials (if used), without fringes and bristle residues (for pork products with skin), edges are trimmed evenly</td></tr>
<tr><td colspan="2">skinned or skinless or partially skinned without film</td><td colspan="3" rowspan="2">tightly rolled with the skin or subcutaneous fat layer (fat) on the outside, with or without a shell (film), with or without a net, tied with twine (threads) along and every (5-8) cm across, or without tying, with or without loop for hanging</td><td colspan="2" rowspan="2">with or without pieces of black or red pepper and garlic, tied with or without twine(s) with or without a loop for hanging</td></tr>
<tr><td colspan="2">or in a film, tied with twine (threads) along and every (10-12) cm across, with a loop for hanging</td></tr>
<tr><td>Form</td><td>Elongated, in the film - rounded, the leg is removed at the hock joint, the pelvic bone is removed</td><td>Rectangular, flat, leg removed from place of the wrist</td><td colspan="3">Cylindrical, oval, rounded, pressed, in shapes - oval, rectangular, cylindrical or other shapes</td><td>Oval, round</td><td>Rectangular</td></tr>
</table>

**Continuation of table 2.9 a**

<table>
<tr><td>1</td><td colspan="3">2</td><td>3</td><td>4</td><td colspan="2">5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Consistence</td><td colspan="3">In boiled, smoked-cooked, smoked-baked - elastic, in raw smoked - dense</td><td colspan="2">Dense</td><td colspan="2">Flexible</td></tr>
<tr><td rowspan="3">Sectional view</td><td colspan="5">The muscle tissue is pink-red without gray spots</td><td colspan="3" rowspan="3">Muscle tissue is light gray or light pink in color, the color of fat is white or with a light pink tint</td></tr>
<tr><td colspan="2">without a layer of fat</td><td colspan="3">with layers of fat</td></tr>
<tr><td colspan="5">the color of fat is white or with a light pink tint, the color of the skin is yellowish-gray</td></tr>
<tr><td>Smell and taste</td><td colspan="9">The smell of ham, pleasant, characteristic of a cooked, or baked, or fried product, with the aroma of spices or spices and garlic - in aged meat, cold-cooked meat, with the aroma of spices / smoking - in smoked-boiled, smoked-baked, raw-smoked products, the taste is salty , without extraneous taste and smell</td></tr>
</table>

## Table 2.9 b. Organoleptic indicators of pork products

| Indicator | Characteristic | | | | | | |
|---|---|---|---|---|---|---|---|
| | Bacon pressed the first grade boiled | Neck higher grade boiled smoked-boiled baked-fried | Pastroma of the highest grade smoked-baked | Brisket pressed higher grade cooked | The meat of pig heads pressed, second grade, boiled | Pork pressed higher grade cooked | Cooked, smoked-cooked pork ham of the highest grade |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Appearance | The surface is clean, dry, intact, treated with decorative materials (if used), without fringes and bristle residues (for pork products with skin), edges are trimmed evenly | | | | | | Loaves with a clean, dry surface, without damage to the shell, with or without a net, tied with twine (threads) cross-wise - in blisters or along and every (5-8) cm across - in other shells, with or without tying, with or without a loop for hanging |
| | | tied with twine (threads) or without tying, with or without a net, with or without a loop for hanging | with or without particles of black or red pepper and garlic | | | | |
| Form | Oval, rectangular, cylindrical or other shape | Cylindrical, rectangular or oval-elongated | Rectangular, slightly elongated, 2 cm to 3 cm long | | Oval, rectangular, cylindrical or other shape | | Cylindrical, oval, round, in the forms - oval, rectangular, cylindrical or another form |
| Consistence | Dense | Flexible | | | Dense | | |

**Continuation of table 2.9 b**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| Sectional view | The muscle tissue is pink-red, with layers of fat; the color of fat is white or with a light pink tint | | | | | Muscle tissue of gray or light pink color, along perimeter- layer of white lard or with a light gray shade | Muscle tissue is pink-red without gray spots, fat is white or with a light pink tint |
| Taste and smell | The smell of ham, pleasant, characteristic of a boiled or baked or fried product, with the aroma of spices, spices and garlic - in the boiled, baked neck, pressed, boiled bacon, spices and bay leaves - in the meat of pork pressed heads, spices and onions - in pressed boiled pork; the aroma of spices and smoking - in smoked and baked products, the taste is salty, without extraneous aftertaste and smell | | | | | | The smell of ham is pleasant, the taste is salty, without extraneous aftertaste and smell |

## Table 2.9 c. Organoleptic indicators of pork products

| Indicator | Characteristic | | | | | | |
|---|---|---|---|---|---|---|---|
| | Roll made of high-grade thigh and scapular meat, smoked-boiled, smoked-baked | Ham from the thigh parts higher grade smoked-boiled smoked-baked | Higher grade smoked-boiled, smoked-baked, raw-smoked loin | Brisket higher grade smoked-boiled smoked-baked raw smoked | Bacon of the highest grade from the neck-shoulder or chest-abdominal part, smoked and baked | Balyk, fillet higher grade smoked-boiled, raw smoked | Neck higher grade raw smoked |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Appearance | Loaves with a clean, dry surface without damage to the shell, tied with twine (threads) on both sides lengthwise and every 5 cm across or without binding with a loop for hanging | The surface is clean, dry, intact, treated with decorative materials (if used), without fringes and bristle residues (for pork products with skin), edges are trimmed evenly | | | | | |
| | | folded with the skin outwards in the form of a roll, tied with twine (threads) along and across every (5-8) cm - smoked-baked, 1.5 cm - smoked-boiled, with a loop for hanging | with or without film, tied with twine (threads) lengthwise and every (10-12) cm across or without binding with a loop for hanging | | tightly folded with the skin outside in the form of a roll, tied with twine (threads) lengthwise and every (5-8) cm across, with a loop for hanging | with or without casing (film), tied with twine (threads) lengthwise and every (5-8) cm across or without binding, with or without a loop for hanging, in red pepper | |

**Continuation of table 2.9 c**

<table>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td rowspan="3">Form</td><td rowspan="3">Cylindrical, round</td><td rowspan="3">Rounded, elongated</td><td>Rectangular, with ribs, vertebrae removed</td><td>Rectangular, with or without ribs, the underbelly is removed</td><td rowspan="3">oval-cylindrical</td><td>Elongated</td><td>Rectangular</td></tr>
<tr><td colspan="2">the thickness in the thin part is not less than</td><td colspan="2" rowspan="2">or cylindrical round</td></tr>
<tr><td>4 cm - smoked-baked, 3 cm - smoked-boiled, raw smoked</td><td>3 cm - smoked-baked, 2 cm - smoked-boiled, raw smoked</td></tr>
<tr><td>Consistence</td><td colspan="5">Flexible</td><td>Dense</td></tr>
<tr><td rowspan="3">Sectional view</td><td colspan="3" rowspan="3">Muscle tissue is pinkish-red, without gray spots, the color of fat is white or with a light pink tint</td><td colspan="2" rowspan="3">Adipose tissue with layers of muscle tissue of pink-red color; the color of fat is white or with a light pink tint</td><td colspan="2">Muscle tissue</td></tr>
<tr><td>pink in color, without gray spots with orange color on the edges or without them</td><td>red, without gray spots with layers of fat</td></tr>
<tr><td colspan="2">the color of fat is white with a light pink tint</td></tr>
<tr><td>Smell and taste</td><td colspan="7">The smell is pleasant with the aroma of spices and smoking, the taste is salty, without extraneous aftertaste and smell</td></tr>
</table>

## Table 2.9. Organoleptic indicators of pork products

<table>
<tr><td rowspan="2">Indicator</td><td colspan="6">Characteristic</td></tr>
<tr><td>Cheek meat of the second grade, smoked and boiled</td><td>Pork heads of the second grade, smoked and boiled</td><td>The shank of the third grade raw-smoked</td><td>Raw-smoked shin of the third grade</td><td>Products made from lard of the first grade are salty</td><td>Ribs of the second grade raw smoked</td></tr>
<tr><td rowspan="2">Appearance</td><td colspan="5">The surface is clean, dry, intact, without fringes and bristle residues (for pork products with skin), the edges are trimmed evenly</td><td rowspan="2">The surface is clean, dry with no more than 30% intercostal meat with a loop for hanging</td></tr>
<tr><td>With a loop for hanging</td><td>No slime, soot, mold with hanging loop</td><td colspan="2">With a loop for hanging</td><td>With meat residues on the surface in an amount of no more than 5% of the fat mass</td></tr>
<tr><td>Form</td><td>Polygonal, flat</td><td>Elongated, polygonal, flat</td><td colspan="2">Elongated, oval</td><td colspan="2">Rectangular, elongated</td></tr>
<tr><td>Consistence</td><td>Flexible</td><td colspan="5">Dense</td></tr>
<tr><td rowspan="2">Sectional view</td><td>The muscle tissue is pink, without gray spots</td><td>Adipose tissue with a layer of muscle tissue of pink-red color</td><td rowspan="2">The muscle tissue is red, without gray spots</td><td rowspan="2">The fat is white with a pink tint, the color of the skin is yellowish-gray</td><td rowspan="2">The muscle tissue is red, without gray spots</td></tr>
<tr><td colspan="2">The color of fat is white with a light pink tint; the color of the skin is yellowish-gray</td></tr>
<tr><td>Smell and taste</td><td colspan="6">The smell is pleasant with the aroma of spices / smoking, the taste is salty, without extraneous aftertaste and smell</td></tr>
<tr><td colspan="7">Note. Requirements for pork products with their own names (if they exist) regarding appearance, shape, cut appearance, smell and taste are specified in the technological instructions for this DSTU, approved in the prescribed manner</td></tr>
</table>

**Table 2.10. Organoleptic indicators of delicacy products made from the meat of piglets and calves**

<table>
<tr><td rowspan="3">Indicator</td><td colspan="4">Characteristic and norm</td></tr>
<tr><td colspan="2">Pig meat roll</td><td colspan="2">Veal leg</td></tr>
<tr><td>smoked and boiled</td><td>stuffed smoked and boiled</td><td>smoked and cooked in lard</td><td>grilled</td></tr>
<tr><td rowspan="3">Appearance</td><td colspan="4">The surface is clean, dry, undamaged</td></tr>
<tr><td colspan="2">Tightly folded with the skin on the outside, tied with twine on both sides lengthwise and every 20-30 mm across, with a loop for hanging</td><td rowspan="2">In a sheath, tied with twine on both sides lengthwise and in the middle across, with a loop for hanging</td><td rowspan="2">In the shell. The ends of the sheath are tied with twine with a loop for hanging</td></tr>
<tr><td></td><td>with the remaining length of twine at the lower end of the loaf</td></tr>
<tr><td>Form</td><td colspan="3">cylindrical</td><td>oval</td></tr>
<tr><td>Consistence</td><td colspan="4">Flexible</td></tr>
<tr><td rowspan="2">Sectional view</td><td colspan="3">Uniformly colored muscle tissue of light pink color, without gray spots, the color of fat is white or with a light pink tint</td><td rowspan="2">Muscle tissue light gray or light pink color</td></tr>
<tr><td></td><td>in the center - evenly mixed minced meat of pink or light pink color</td><td>a layer of lard not thick greater than 4 mm</td></tr>
<tr><td>Smell and taste</td><td colspan="3">Pronounced smell of smoking, salty, without extraneous taste and smell, with the aroma of spices</td><td>The smell and taste are characteristic of baked veal, without extraneous taste and smell, with the aroma of spices and garlic</td></tr>
<tr><td colspan="5">Note. The free ends of the sheath and the twine must not be more than 20 mm, and if there is a trade mark, the free end of the twine must not be more than 70 mm</td></tr>
</table>

**Table 2.11. Organoleptic indicators of meat pates**

| Indicator | Characteristic and norm | | | | | |
|---|---|---|---|---|---|---|
| | Higher grade | | | First grade | | |
| | Ham | Capital | For Children | Livery | To breakfast | Ukrainian |
| Appearance | The surface of the pastes is clean and even. There may be a slight release of jelly and fat on the surface of the pates | | | | | |
| Consistency | Dense | | Gentle, smear | Barely smear | | |
| Cutaway view of minced meat | The minced meat is gray (for children - with a yellowish-brown tint), evenly mixed. May have a pink tint | | | | | |
| Taste and smell | The taste is pleasant, characteristic of pates, slightly salty, with a pronounced aroma of spices, without extraneous aftertaste and smell, in ham pate - with the aroma of smoking | | | | | |
| Pate form | Truncated pyramid, rectangular parallelopiped, segment or other | | | | | |
| Trade mark on the minced meat pate by weight (letter) | S | C | D | L | DC | U |

### 2.1.6. Organoleptic assessment of the quality of semi-finished products

Organoleptic analysis of semi-finished products is carried out in raw form and after heat treatment, depending on the method of eating them as follows:

- in raw form - the appearance, color and smell (aroma) are evaluated;

- in finished form - by bringing the product to readiness (heat treatment) determine the appearance, consistency, cut appearance of minced meat, smell (aroma), taste.

Organoleptic indicators of the quality of semi-finished products are given in tables 2.12 - 2.13.

## Table 2.12. Organoleptic indicators of semi-finished meat and meat-vegetable chopped products

| Indicator | Characteristic | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Minced meat | Beefsteaks | Hamburgers | Cutlets | | Romsteks | Meatballs | | Schnitzels | Pelmeni | |
| | | | | Meat | Meat and vegetables | | Meat | Meat and vegetables | | Meat | Meat and vegetables |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Appearance | A homogeneous mass without bones, cartilage, tendons, rough connective tissue, blood clots | rounded-flattened | rounded-flattened | oval, oval-flattened | | rounded-flattened | spherical when shaking, the packaging unit makes a clear, distinct sound | | rounded-flattened the surface is evenly covered with breading, without broken edges | semicircular, rectangular, square or hexagonal; the edges of the dough shell are tightly glued, the minced meat does not protrude, while shaking the packaging. units give a clear expressive sound | |
| Sectional view | The minced meat is evenly mixed, from dark red to light pink in color | | | | | | | | | | |
| | | with pieces of lard of white color or with a pale pink tint | | | with the presence of vegetables, cereals according to the recipe | | | with the presence of vegetables, cereals according to the recipe | minced meat contains pieces of white lard; lard may have a pale pink hue | | with the presence of vegetables, cereals according to the recipe |

**Continuation of table 2.12**

<table>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td colspan="2">5</td><td>6</td><td>7</td><td colspan="2">8</td><td>9</td><td>10</td><td colspan="2">11</td><td>12</td></tr>
<tr><td>Consistency</td><td>touching</td><td>Dense, fried - juicy, not fragile</td><td>When fried, it is juicy, not brittle</td><td colspan="3">Dense, fried - juicy, tender, not fragile</td><td>Dense, fried - juicy, not fragile</td><td colspan="2">In boiled form - juicy, tender, not fragile</td><td>Dense, fried - juicy, not fragile</td><td colspan="3">In cooked form, the minced meat is juicy, tender, the dough shell is not torn, it does not lag behind the minced meat</td></tr>
<tr><td rowspan="2">Taste and smell</td><td colspan="12">The taste and smell are characteristic of good-quality raw materials and spices, without extraneous aftertaste, smell (for the product in its raw state)</td></tr>
<tr><td></td><td colspan="7">in fried form - characteristic of the given product</td><td colspan="2">in boiled - characteristic of the given product</td><td>in fried - characteristic of the given product</td><td colspan="2">in boiled - characteristic the given product</td></tr>
<tr><td colspan="13">Note. The technological instruction to this standard, which was approved in accordance with the established procedure, provides for the requirements that characterize the proper name of the semi-finished product in terms of appearance on the cut, taste and smell, shape</td></tr>
</table>

**Table 2.13. Organoleptic indicators of frozen semi-finished products with meat in a dough shell**

<table>
<tr><td rowspan="2">Indicator</td><td colspan="5">Characteristic</td></tr>
<tr><td>Vareniki</td><td>Manti</td><td>Ravioli</td><td>Khinkali</td><td>Cheburek</td></tr>
<tr><td rowspan="2">Appearance</td><td>The shape of a hemisphere or another, the edges are tightly glued</td><td>Rounded-flattened shape, the edges are tightly glued and made in the shape of a figure eight with three catches (two on the side, one on top) or another shape</td><td>Round, square or other shape, the edges are tightly glued</td><td>Rounded-flattened shape, the edges are tightly glued and twisted like a cone or other shape</td><td>Semicircular or other shape, the edges are tightly glued</td></tr>
<tr><td colspan="5">The products have a dry surface, are not deformed, not stuck together, and the minced meat does not protrude from the dough. The packaging unit is shaken, while a distinct, clear sound is heard</td></tr>
<tr><td rowspan="2">Sectional view</td><td colspan="5">The dough shell is white to cream in color, with the filling evenly mixed</td></tr>
<tr><td>gray-brown color</td><td colspan="4">from dark red to light pink color, gray-brown color - with the use of onions, available spices, greens, other ingredients (according to the recipe)</td></tr>
<tr><td rowspan="2">Consistence</td><td colspan="3">In boiled form</td><td rowspan="2" colspan="2">The dough shell is dense, whole, the minced meat is juicy - for fried products</td></tr>
<tr><td>juicy, soft</td><td colspan="3">- the minced meat is juicy, tender, the dough shell is not torn</td></tr>
<tr><td>Taste and smell</td><td colspan="4">In boiled form - characteristic of the product without extraneous smell and taste</td><td>In the fried form - characteristic of the product, without extraneous smell and aftertaste</td></tr>
<tr><td colspan="6">Note 1. The shape of semi-finished products is determined by the technical capabilities of the equipment Note 2. Slight deformation of semi-finished products, the presence of a conveyor print on the lower part of semi-finished products is allowed</td></tr>
</table>

### 2.1.7. Organoleptic assessment of the quality of canned food and characteristics of indicators

The results of organoleptic evaluation are often final and decisive in determining the quality of products, especially new types. Organoleptic quality indicators include appearance, color, smell, consistency, broth transparency, taste, aroma, juiciness, tenderness, etc. They mainly use point evaluation. With the scoring method, each score corresponds to a verbal definition of the level of product quality.

The scale (tasting journal or sheet) is compiled in such a way that the sequence of determining quality indicators corresponds to the natural sequence of organoleptic perception. First of all, quality indicators are evaluated with the help of visual organs (appearance, cross-section, color), then smell, consistency, and finally quality indicators determined by taste. The tasters evaluate the product consistently according to individual quality indicators in accordance with the descriptive characteristics with data entry in the tasting journal, which has an approved form. In the journal, you can also indicate suggestions for improving the quality of products.

The composition of the tasting committee of the factory is approved by the order of the enterprise. The commission is headed by the chief engineer or chief technologist of the meat processing plant. The commission includes: the chief technologist of the enterprise, the head of the production and veterinary control department, head laboratories, bacteriologist, factory director, technologist of the factory, senior foreman of the factory. The commission meets once a week. Tasting of canned goods is carried out on the 14th day from the day of production. On the day of the tasting for all batches of canned food, the samples of which are selected for organoleptic evaluation and presented for decision-making by the tasting commission regarding the sale of the presented canned food, the laboratory of production and veterinary control presents the results of the conducted physical-chemical and bacteriological studies.

The form of the tasting log is given below.

## Tasting journal

| № | Name of canned goods | Date | Shift | № of can | № of party | Sort | Number |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
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## Tasting journal

| Organoleptic evaluation of products according to the 5-point system | | | | | | | |
|---|---|---|---|---|---|---|---|
| Product appearance | Color and cross-sectional view | Smell and aroma | Taste | Consis-tence | Succu-lence | Overall quality assessment in points | Remark |
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Evaluation of the appearance of cans. When checking the appearance of an average sample of canned goods, first of all, you should establish the presence and condition of the lithographic print or labels, as well as the content of the inscription on them. At the

same time, pay attention to whether the label is correctly pasted, whether there is contamination, design. If the inscriptions are made by the lithographic method, then the clarity and indistinctness of the image are noted. The labels are checked for compliance of the details with the requirements of the standards. Then, in accordance with the current regulatory documents on packaging and labeling, the correctness of labeling is assessed.

In canned goods in metal cans, the presence of deformations of the body, bottoms and lids, rusty spots, the degree of their distribution, defects of longitudinal and rolling seams are noted; in aluminum containers and lacquered metal ones - damage to the varnish coating, crumpling; in the glass container there can be cracks, rusty spots on the metal lids. In all cases, leakage, swelling of the lids and bottoms, deformations of the bottoms and lids in the form of corners at the sides of the cans, "flappers", etc., are noted in all cases.

*Determination of the condition of the inner surface of the metal container.* The cans are opened and emptied of their contents, after which the inner surface is thoroughly washed with water and wiped dry. When evaluating, attention is paid to the presence and degree of distribution of dark spots, which may appear as a result of the dissolution of sludge or as a result of the formation of sulfur and other compounds. If there are rusty spots on the inner surface of unvarnished tin cans, the extent of their spread is noted.

Next, determine the condition of the varnish or enamel on the inner surface of the varnished container, as well as the condition of the sealing paste applied to the rolling field of the metal lids. The presence and size of solder flows inside the cans are also established. Similarly, the condition of the inner surface of the metal lids used to close the glass jars is determined.

*Organoleptic assessment of the content of canned food.* The entire contents of the can are subjected to inspection and evaluation, transferring it to a plate. They evaluate the appearance of meat, broth, meat juice, sauce, color, smell, taste, consistency, appearance on a cut, appearance of meat juice in a heated state, etc. for compliance with the requirements of the current regulatory and

technical documentation for products. Product samples are evaluated in a cold or heated state, depending on the method of its consumption.

When evaluating the appearance of the product in accordance with the requirements of regulatory and technical documentation, the color, shape, character of the surface, uniformity, size of pieces of meat or offal, quality of laying of tongues or poultry meat, condition of broth, sauce, meat juice, jelly are evaluated. If the contents consist of liquid and solid components, first you need to evaluate the transparency of the liquid part of the canned food, its color. The evaluation is carried out as follows: open the cans, pour the liquid part into a beaker made of colorless glass (diameter 6-8 cm), let the liquid part settle at a temperature of 20 ºC, then examine it under light on a white background. At the same time, pay attention to the presence of suspended protein substances in the form of flakes in a layer above the settled meat juice or broth. After draining off the liquid part, the solid part of the canned food is placed in a plate and evaluated in accordance with the regulatory and technical documentation applicable to the studied canned food.

When evaluating the appearance of the meat, attention is paid to the condition of the pieces of meat, their size, whether the product holds its shape when removed from the can, whether the fat has melted, the color of the fat, the condition and color of the jelly, sauce. For meat-vegetable canned goods pay attention to the characteristics of the cereal (crumbliness, cookedness, presence of lumps). For canned minced meat pay attention to the homogeneity of the minced meat, when evaluating pates - the homogeneity of the pate mass.

The consistency is characterized by the following terms: dense, juicy, elastic, pasty, semi-viscous for porridge, the meat does not fall apart when removed from the can, the slices do not fall apart when cutting, etc.

Depending on the method of consumption of canned goods (indicated on the label), the organoleptic evaluation of their quality is carried out in a cooled or heated state.

To carry out tasting of canned goods, which are consumed in a heated state, closed canned goods are placed in boiling water for 20-30 minutes (depending on the size of the can) and heated to a temperature of 50-60 ºC. After heating, open the cans, pour the broth (if available) into glass (diameter 50 cm3), let it settle and evaluate the transparency. The solid part is carefully laid out in a plate to determine the quality indicators.

To assess the quality of canned goods that are used in a cooled state, they are cooled in the refrigerator, with the lids down, at a temperature of 0-4 ºC for at least 1 day, after which they are opened, carefully removed from the can, without breaking the shape, cut into slices, as thin as its integrity allows. Canned jelly is evaluated similarly: after cooling in the refrigerator, the contents of the canned food are carefully removed from the can and cut together with the jelly, without separating it from the meat part of the canned food. Pate preserves are served on the tasters' plate, grabbing a certain amount of pate with a narrow knife. Canned foods that do not require prior preparation are served for tasting at a temperature of 18-23 ºC.

The organoleptic indicators of canned meat are given in table. 2.14 - 2.21.

**Table 2.14. Organoleptic indicators of canned meat "Minced pork sausage"**

| Indicator | Characteristic and norm |
|---|---|
| Appearance in section | The minced meat is pink without gray spots, homogeneous, without cavities and free broth, without visible particles of connective tissue |
| Consistency | Dense, not fragile |
| Smell and taste | Characteristic of this type of canned food, juicy, with a pronounced aroma of spices, without extraneous smell and aftertaste |

**Table 2.15. Organoleptic indicators of canned meat "Stewed meat"**

| Indicator | Characteristic | |
|---|---|---|
| | higher grade | first grade and for non-grade canned goods |
| Appearance | Stewed meat in pieces of at least 30 g, which does not contain cartilage, coarse connective tissue, vascular bundles | |
| The color of the meat | The meat is light gray to dark gray in color | |
| In the heated state, the color and appearance of the meat juice | The juice is yellow or light brown | From yellow to brown |
| | with the presence of suspended protein substances in the form of flakes | |
| Consistence | The meat is juicy, not overcooked, which does not fall apart when carefully removed from the can | |
| | the pieces do not fall apart | partial disintegration of pieces is possible |
| Smell, taste | Characteristic of stewed meat, which has the aroma of spices, does not have an extraneous smell, aftertaste | |

**Table 2.16. Organoleptic indicators of canned meat "Offal pate"**

| Indicator | Characteristic and norm |
|---|---|
| Appearance | A homogeneous, finely ground mass of gray-brown color or with a pink tint |
| Consistence | Paste-like, smear. Uniform throughout the mass |
| Smell and taste | Inherent in boiled offal with a pronounced aroma of spices, without extraneous smell and taste |

**Table 2.17. Organoleptic indicators of canned food "Poultry in natural juices"**

| Indicator | Characteristic |
|---|---|
| Appearance | This type of poultry with pieces of meat on the bone, in jelly or broth, contains visible inclusions of spices, white roots or carrots. Skin surface without stumps, hair-like feathers, hemorrhages |
| The color of the meat | Boiled meat with the characteristic color of this type of bird |
| Color of jelly (broth) | Golden yellow, changing to dark yellow |
| Smell and taste | Characteristic of the meat of this type of bird in its own juice, pleasant, which combines with spices and roots, without extraneous smell and taste |
| Consistency | The meat is juicy, easily separated from the bones |

**Table 2.18. Organoleptic indicators of canned meat and vegetables "Meat porridge"**

| Indicator | Characteristic and norm |
|---|---|
| Appearance and consistency | The porridge is well cooked, crumbly without lumps with finely chopped meat.<br>A semi-viscous consistency is allowed for pearl, barley, millet porridge |
| Smell and taste | Specific to this type of product |
| Color | Characteristic of this type of cereal with meat |

## Table 2.19. Organoleptic indicators of canned poultry meat and offal

| Indicator | Characteristic | | | |
|---|---|---|---|---|
| | Canned meat | | Canned food from sterilized by-products | |
| | Pasteurized "Meat of broiler chickens" | Sterilized "Chicken ham meat" | "Poultry offal in natural juices" | "Poultry offal with vegetables" |
| Appearance | Breast meat in pieces, carcass thigh with skin, in jelly (broth), sprinkled with connective tissue, spices - for chicken meat ham | | Muscle stomach, heart, liver, neck, wings in pieces, in jelly (broth), with vegetables and spices | |
| Color:: | | | | |
| - meat | Inherent in boiled meat | | - | |
| - offal | - | | Inherent in cooked offal | |
| - jelly (broth) | From golden yellow to dark yellow | | From cream to dark brown or dark gray | From yellow to dark brown, the presence of suspended protein substances is allowed |
| Smell and taste | The smell and taste is characteristic of the meat of the corresponding type of bird, pleasant, without extraneous smell, taste | Characteristic of salted and boiled poultry meat of the appropriate species, pleasant, with spices, no extraneous smell and taste | Characteristic of poultry offal cooked in its own juice, with spices, vegetables, no extraneous smell, taste | |
| Consistence | The meat is juicy. During slicing, pieces with a thickness of 0.3 to 0.5 cm do not fall apart | | Offal when cut into pieces should not fall apart, not overcooked, juicy | |
| **Note** | The presence of connective tissue is allowed on a cut of meat | | | |

**Table 2.20. Organoleptic indicators of canned meat ham**

| Indicator | Characteristics of canned goods | | | |
|---|---|---|---|---|
| | Pasteurized from pork | Sterilized from pork | Pasteurized from beef | Sterilized from beef |
| Appearance | The contents of canned goods are one piece, which retains its shape when removed from the can. The color of the jelly is yellow, with varying intensity, or with a pink tint. Melted fat is present | | | |
| Cross-sectional view, color | Muscle tissue of pink color of varying intensity without gray spots | | | |
| | without visible adipose tissue or with its inclusions | | with visible inclusions of connective tissue | with visible inclusions of connective and adipose tissue |
| Consistence | Elastic, juicy, when cut into slices (thickness from 0.3 cm to 0.5 cm) they do not fall apart | | | |
| Smell and taste | There are no extraneous odors and aftertastes characteristic of salted and boiled ham | | | |

## Canned meat. Porridge with meat

Canned foods, depending on the raw material, are produced the following names:

• Porridge (barley or pearl barley, or rice, or buckwheat, or millet) with beef;

• Porridge (barley or pearl barley, or rice, buckwheat, or millet) with pork;

• Porridge (barley or pearl barley, or rice, buckwheat, or millet) with lamb;

• Porridge (pearl barley or rice) with meat and offal;

• Porridge (pearl barley or buckwheat or rice) with soy and meat.

**Table 2.21. Organoleptic indicators of canned meat and vegetables. "Meat porridge"**

| Indicator | Characteristics of canned goods |
|---|---|
| Appearance and consistency | Cereals well cooked, crumbly or semi-viscous consistency without lumps with pieces of meat measuring sides from 12 mm to 16 mm |
| Smell and taste | Characteristic of the type of cereal with meat, with the aroma of spices, without extraneous smell and aftertaste |
| Color | A type of cereal with meat |

### Canned minced meat (Table 2.22-2.38)

Canned food, depending on the meat raw material, produces the following names:

• Minced pork;
• Minced pork with added lard;
• Pork and beef minced meat;
• Pork and beef mince with lard.

**Table 2.22. Organoleptic parameters of canned minced meat**

| Indicator | Characteristics of canned goods |
|---|---|
| Appearance | The product is in one piece, retains its shape when removed from the can, the presence of yellow jelly and rendered fat from grayish-white to white-pink colors is possible |
| Cross-sectional view, color | Minced meat from pink to dark red without gray spots and cavities with or without fat and connective tissue, with or without pieces of white lard with a pink tint or semi-fat pork |
| Consistency | Dense, elastic, does not crumble, slices (thickness from 0.3 cm to 0.5 cm) does not fall apart when cut |
| Smell and taste | Characteristic of boiled beef and pork with the aroma of spices, without extraneous smell and aftertaste |

**Table 2.23. Organoleptic indicators of canned meat "Pork snack"**

| Indicator | Characteristic and norm |
|---|---|
| Appearance and texture of meat | Pieces of meat are juicy, undigested, without bones, cartilage, tendons, rough connective tissue, large blood vessels, and lymph nodes.<br>When carefully removed from the can, the pieces do not fall apart |
| Smell and taste | Characteristic of canned pork with spices, without extraneous smell and taste |
| Appearance of meat juice | Meat juice has a yellow color that changes to light brown when the product is heated, suspended protein substances are present in the form of flakes. Slight turbidity of the meat juice is allowed |

**Table 2.24. Organoleptic indicators. Canned meat "Liver pate"**

| Indicator | Characteristic and norm |
|---|---|
| Appearance | A homogeneous mass of brownish-gray color |
| Consistency | Pasty, homogeneous throughout the mass, without grains |
| Smell and taste | Characteristic of boiled liver with a slight natural bitterness and pronounced aroma of spices without extraneous smell and aftertaste |

**Table 2.25. Organoleptic indicators of canned meat "Tourist's breakfast"**

| Indicator | Characteristics and norms |
|---|---|
| Appearance and consistency | Pieces of meat and fat are well bound, in a cooled state, when carefully removed from the can, they do not fall apart.<br>When cutting, keep the shape of the slices. Meat juice in a jelly-like state. A small amount of freely separated fat is allowed |
| Smell and taste | Properties of cooked ham salt pork with spices, beef or lamb aged in salt with spices, without extraneous taste and smell |
| Color | Meat tissue from pink to red, varying intensity of color, pork fat is white or with a pink tint, beef and mutton - with a yellowish tint. Yellow jelly |

**Table 2.26. Organoleptic indicators of canned meat "Meat for breakfast"**

| Indicator | Characteristics and norms |
|---|---|
| Appearance | Pieces of meat trimmings and diaphragms in tomato sauce. The color of the sauce is from orange to light brown |
| Consistency | Pieces of meat trimmings and diaphragms are soft, uncooked. The sauce is uniform, without lumps |
| Smell and taste | Characteristic of meat in tomato sauce, without extraneous smell and taste |

**Table 2.27. Organoleptic indicators of canned meat "Stewed beef"**

| Indicator | Characteristics and norms | |
|---|---|---|
| | higher | first |
| Smell and taste | Stewed beef is characteristic, there are spices, there are no extraneous odors, aftertastes | |
| Appearance of meat, consistency | Pieces of meat weighing more than 30 g, juicy, uncooked; without bones, cartilage, tendons, rough connective tissue, large blood vessels, lymphatics, nerve nodes | |
| | When carefully removed from the can, the pieces do not fall apart | When carefully removing from the jar, the pieces may disintegrate slightly |
| Appearance of meat juice | Meat juice in a heated state has a yellow color with a change to light brown, suspended protein substances are present in the form of flakes. Slight turbidity of the meat juice is allowed | |

**Table 2.28. Organoleptic indicators of canned meat pate "Original"**

| Indicator | Characteristics and norms |
|---|---|
| Appearance | A homogeneous, finely ground mass |
| Consistence | Pate-like |
| Smell and taste | Inherent in cooked offal with a pronounced aroma of spices, without extraneous smell and taste |
| Color | Gray-brown or with a pink tint |

**Table 2.29. Organoleptic indicators of canned meat "Tongues"**

| Indicator | Characteristics and norms | | |
|---|---|---|---|
| | Tongues in jelly | Tongues in natural juices | Tongue boiled in jelly |
| Appearance | Tongue (slices, pieces, whole) in jelly with freely separated fat.<br>Slices are arranged mainly in horizontal rows.<br>The pieces are cut and stacked according to the height of the can.<br>The number of tongue tips should not exceed 50% of the total mass of tongues in the jar.<br>The tongues are whole, without cuts, the outer surface is placed against the wall of the jar.<br>It is allowed to have no more than three doses in cans with whole tongues or chopped pieces | | |
| Color:<br>- tongue on the cut | From light pink to dark red | | From pink-gray to brown |
| - fat | From white to yellow | | |
| - jelly | From light cream to yellow with a brown tint | | |
| Smell and taste | Characteristic of salted and boiled tongue with the aroma of spices | | Properties of boiled tongue |
| Consistency | In the cooled state, the tongues are elastic, the jelly is dense | | |

**Table 2.30. Organoleptic indicators of canned meat "Choice beef"**

| Indicator | Characteristics and norms |
|---|---|
| Smell and taste | Typical for canned beef with spices, there is no extraneous smell and aftertaste |
| The appearance of the meat, the consistency of the meat | Pieces of meat weighing 30 g or more, uncooked and juicy, without bones, cartilage, tendons, rough connective tissue, large blood vessels and lymph nodes.<br>When carefully removed from the can, the pieces of meat do not fall apart |
| Appearance of meat juice | Meat juice is yellow with a change to light brown in the heated state, suspended protein substances are present in the form of flakes. Slight turbidity of the meat juice is allowed |

**Table 2.31. Organoleptic indicators of canned meat "Poltava beef"**

| Indicator | Characteristics and norms |
|---|---|
| Appearance and texture of meat | Meat in pieces with the presence of connective tissue and collagen in individual pieces.<br>When carefully removing from the jar, the pieces may fall apart |
| The color of the meat | Inherent in boiled beef |
| Smell and taste | Characteristic of stewed beef, without extraneous smell and taste |

**Table 2.32. Organoleptic indicators of canned meat "English and Ukrainian corned beef"**

| Indicator | Characteristics and norms |
|---|---|
| Appearance and consistency | Finely chopped meat, gray-pink in color, in the form of minced meat, when carefully removing the pieces of meat from the can, the pieces of meat do not fall apart, the surface of the minced meat is slightly covered with jelly |
| Smell and taste | Characteristic of canned beef, without extraneous smell and taste |

**Table 2.33. Organoleptic parameters of canned meat "Goulash snack"**

| Indicator | Characteristics and norms |
|---|---|
| Smell and taste | Meat in tomato sauce with fried onions, without extraneous smell and taste |
| Appearance and consistency | Pieces of meat without bones, cartilage and tendons, soft, uncooked, without lumps, in tomato sauce, uniform orange or light brown color |

**Table 2.34. Organoleptic indicators of canned meat "Beef in tomato sauce"**

| Indicator | Characteristics and norms |
|---|---|
| Appearance | Pieces of fatty beef in tomato sauce. The sauce is homogeneous without lumps |
| Consistency | The pieces of beef are not overdone |
| Smell and taste | Characteristic of this type of product, without extraneous smell and taste |
| Color | From orange to brown |

**Table 2.35. Organoleptic indicators of canned meat and vegetables**

| Indicator | Names of canned goods, characteristics and norms | | | | |
|---|---|---|---|---|---|
| | Buckwheat porridge "Lubitelska" | | Buckwheat porridge | | |
| | with beef | with pork | with rumen | ordinary | village |
| Appearance and consistency | Buckwheat porridge without lumps | | | | |
| | with evenly distributed pieces | | | evenly mixed | |
| | beef meat | pork meat | rumen | | |
| | In a cold state, it is a dense mass that does not fall apart, in a heated state, it is crumbly | | | | |
| Smell and taste | Characteristic of buckwheat porridge with | | | | |
| | boiled beef | boiled pork | boiled rumen | fat | pork leg meat |
| | with a pronounced aroma of spices, without extraneous smell and aftertaste | | | | |

**Table 2.36. Organoleptic indicators of offal and blood pudding canned products**

| Indicator | Names of canned goods, characteristics and norms | |
|---|---|---|
| | Ukrainian Aspic | Ukrainian blood pudding |
| Appearance and consistency | Pork tails, cut into pieces, and pinkish-gray beef tail meat in a light yellow jelly of a dense, springy consistency (chilled) | Buckwheat porridge without lumps with boiled blood. When cold, it is a dense mass that does not fall apart, when heated, it is brittle |
| Smell and taste | Characteristic of boiled meat of pork and beef tails with a pronounced aroma of spices, without extraneous smell and aroma | Characteristic of buckwheat porridge with boiled blood, with a well-defined aroma of spices, without extraneous smell and aroma |

**Table 2.37. Organoleptic indicators of canned meat "Meat pate"**

| Indicator | Characteristics and norms |
|---|---|
| Appearance | A homogeneous, finely ground mass with a small amount of deposited fat |
| Color | From pinkish gray to brownish gray |
| Smell and taste | Characteristic of meat pate with the aroma of spices, without extraneous smell and taste |
| Consistency | Paste-like, homogeneous throughout the mass |

**Table 2.38. Organoleptic indicators of canned meat and vegetables "Meat porridge"**

| Indicator | Characteristic and norm |
|---|---|
| Appearance and consistency | The porridge is well cooked, crumbly without lumps with finely chopped meat.<br>A semi-viscous consistency is allowed for pearl barley, barley, millet porridge |
| Smell and taste | Specific to this type of product |
| Color | Characteristic of this type of cereal with meat |

## Questions for discussion and self-examination

1. How is the degree of freshness of meat determined?
2. What indicators and under what conditions are determined by the organoleptic methods?
3. Characterize the organoleptic quality indicators of carcasses obtained after animal slaughter.
4. Describe the method of determining the transparency and aroma of the broth.
5. What organoleptic indicators are determined when determining the quality of poultry meat?
6. Characterize the determination of muscle condition on a cut of poultry meat and fattening of the carcass.
7. Characterize the condition of bone tissue, determination of temperature and weight of poultry meat.
8. Name the purpose of the tasting. What is the tasting like?
9. What is the sequence of tasting meat products depending on organoleptic indicators and thermal state?

10. In what sequence is the organoleptic evaluation of the entire product carried out?

11. Describe the quality indicators of the whole product.

12. How to determine the smell, taste, consistency of the product?

13. What are the important indicators in determining the quality of the cut product?

14. List the basic requirements for tasters who carry out organoleptic evaluation of food products.

15. Describe the method of determining the organoleptic evaluation of the quality of meat after heat treatment.

16. How are samples selected for organoleptic research of sausage products?

17. How is the depth of penetration of mold and slime under the casing of a sausage loaf determined?

18. How are stickiness, sliminess and other indicators of the appearance of the product determined?

19. How do you determine the color and distribution of ingredients in sausage products?

20. How do you evaluate the smell, taste and juiciness of sausage products?

21. What are the requirements when slicing a product to assess organoleptic indicators?

22. What are the requirements and sequence of manual cutting of large pieces of products?

23. Describe the sequence of preparation for machine cutting of pork products.

24. Describe the preparation for the tasting of bone broth, rolls.

25. What are the requirements for the sequence of presentation for tasting of bones, rolls, their slicing, placing on a dish?

26. In what thermal state and what indicators are determined in semi-finished products?

27. Describe the main organoleptic parameters of pelemeni.

28. What are the organoleptic indicators of the quality of canned meat?

29. What is the sequence in determining the organoleptic

quality indicators of canned goods?

30. How is the appearance of cans evaluated?

31. How is the inner surface of a metal container determined?

32. What quality indicators are evaluated during the organoleptic assessment of the content of canned goods?

33. What does the "appearance" indicator include in the organoleptic evaluation of the quality of canned goods?

34. How do you evaluate the organoleptic indicators of canned foods that are consumed in a cooled and heated state?

## *Topic 2.2. Methodology for determining the organoleptic parameters of raw materials and products from hydrobionts*

### 2.2.1. Raw fish

The organoleptic indicators of the quality of raw fish are judged by the condition of its individual organs and tissues, evaluated by a number of indicators. According to their significance in the final assessment of fish quality, these indicators can be divided into basic and additional.

The main signs include the condition of the integument, eyes, abdomen, muscle tissue, gills and gill covers. The structural scheme of the main quality features of raw fish allows to conduct an organoleptic analysis with sufficient completeness, consistently and quickly (Fig. 2.1).

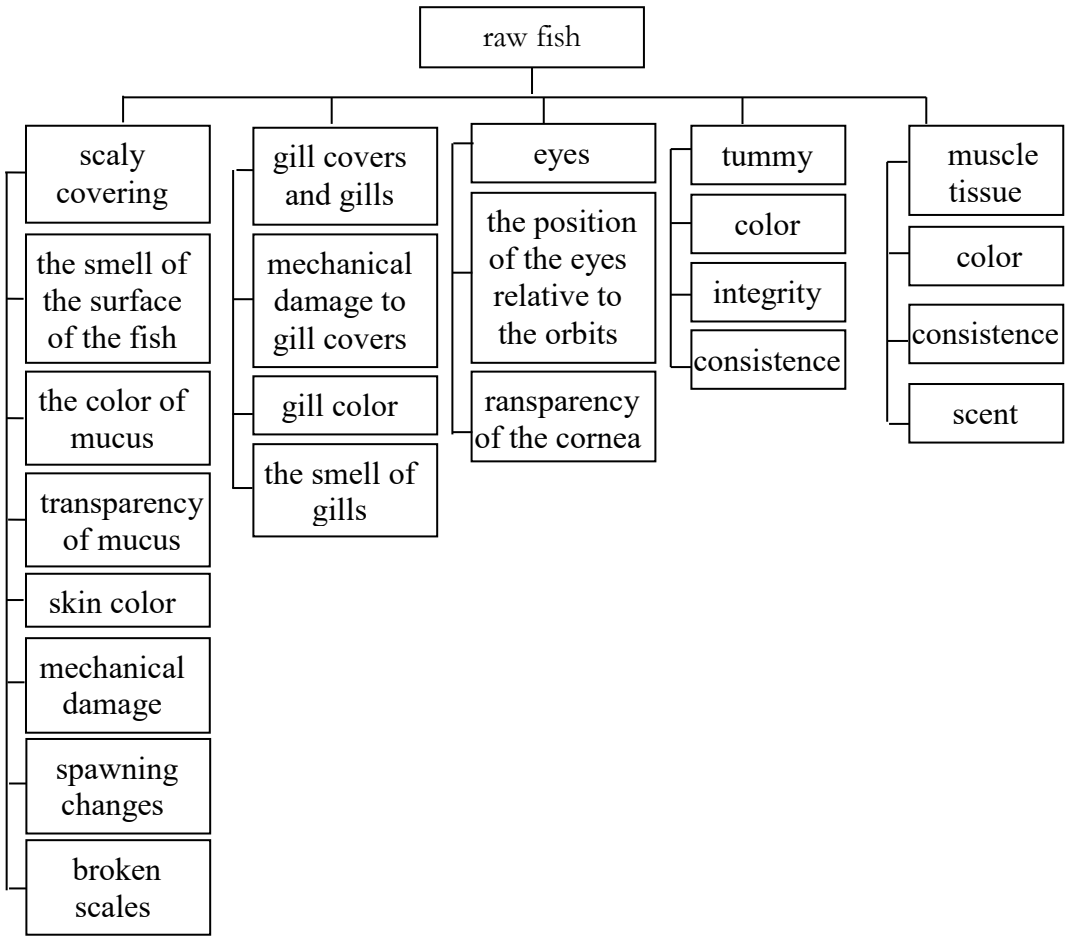


Fig. 2.1. Structural scheme of the main organoleptic indicators that characterize the quality of individual organs and tissues of raw fish

Additional signs include fatness, the color of the anal ring, the smell and color of the meat at the spine, the clarity of the contours and color of the internal organs, the position of the gill covers relative to the body of fish, their color, as well as the color, transparency and consistency of the mucus in the gills, the presence of helminths in internal organs and muscle tissue.

The study of additional signs is necessary in those cases when the assessment of the main signs does not allow obtaining a sufficiently complete picture of the quality of the organ or tissue. Usually, to assess the quality of fish, not all additional signs are determined, but only those related to the certain types of raw fish.

For example, in coalfish, kaluga, pacific herring, such a sign is the transparency of the cornea of the eye, in pollock - the color of internal organs.

*Skin-scaly cover*. When evaluating the skin-scaly cover, the following main signs are determined: the smell of the surface of the fish, the transparency and color of the mucus, the color of the skin, mechanical damage, broken scales and spawning changes.

When starting to examine the skin-scale cover of raw fish, first of all, the smell of the surface of the fish is evaluated by sniffing it. The smell of fish, depending on the degree of its freshness, changes from normal without signs of spoilage (sometimes with an admixture of iodide or silt) to rotten. Slime is evaluated by color and transparency, as changes in these quality indicators tell the first signs of fish spoilage. In fresh fish, the mucus is transparent and colorless. As the degree of freshness of the fish decreases, the mucus becomes cloudy and acquires various colors depending on the stages of deterioration and the type of fish: whitish, milky, creamy, yellow, gray-bloody, etc.

To determine the color of the scaly skin, the surface of the fish is carefully washed of mucus, after which the degree of change in natural color is determined. In fresh fish, the natural color of the scaly skin can be diverse: light silver, silver with reddish shades, dark silver, black. As the quality of the fish deteriorates, its color becomes dull or dull over the entire surface or in places. As a result of hemorrhage, reddening of the surface of the body, the formation of spots and stripes of various colors can be observed.

Mechanical damage to the scaly skin of raw fish (wounds, bruises, skin breaks, bites, traces of decoration, etc.) may be absent, minor or significant. The brokenness of the scales as a sign of quality is determined in fish with densely seated scales (for example, in ordinary fish, smelts, etc.). It can completely cover the skin of the fish or be knocked down in different areas of the skin.

Spawning changes in all fish species are the same. In salmonids, for example, they are manifested in the form of a hump, curvature of the jaws, an increase in the size of the teeth, mating color.

*Gill covers and gills.* The condition of the gill covers is characterized by one main (mechanical damage) and two additional (position in relation to the gills and color) signs. The latter are evaluated only in certain types of fish: herring, anchovy and some others.

When determining mechanical damage to the gill covers, they are carefully inspected; they can be whole, damaged or broken off. The quality of the fish is also judged by the position of the gill covers in relation to the gills.

The gill covers are considered tightly fitting if there are no gaps between them and the body of the fish; slightly open, if the gill covers form narrow slits through which the gills are not yet visible, and finally open, when the gill covers are considerably raised, the slits are wide and the gills are exposed. The color of the gill covers is assessed by the level of expression of the natural color and the appearance of red spots on their surface. Redness of the gill covers in itself is not a sign of spoilage of raw fish, but in the presence of other symptoms that confirm insufficient freshness of the fish, this indicator is used as an additional sign.

Gills are evaluated according to two main characteristics: color and smell. To determine the color, open the gill covers with your hands and examine the gills, noting the degree of their color change. Depending on the type of fish and the degree of its deterioration, the gills can be bright red, red, dark red, reddish brown, pink, pale pink, discolored, dirty pink, dark brown, gray, etc.

As an additional sign, you can use the condition of the mucus in the gills, which is determined by its color, transparency, consistency, and smell. In the process of storage, mucus on the gills turns from colorless to pink, red, cherry, cherry-dirty or greenish-dirty. In fresh fish, the mucus in the gills is transparent, as the quality deteriorates, it becomes cloudy. The consistency of the mucus, determined by rubbing it between the fingers, can be of normal thickness, thick, or watery.

The smell of gills is determined by sniffing, focusing on the degree of their characteristic smell or the appearance of the smell of spoilage.

*Eyes.* The condition of the eyes of the fish is evaluated by two main features: the position of the eyes in relation to the orbits and the transparency of the cornea. Fish eyes can be located slightly above the level of the orbits (convex), at the level of the orbits (flat), slightly below the level of the orbits (slightly sunken), below the level of the orbits (in the center), well below the level of the orbits (sunken). The position of the eyes in relation to the orbits is determined in shallow-water fish species.

The condition of the cornea is determined by its transparency or degree of cloudiness. As the fish is stored, the transparent cornea becomes cloudy.

*Abdomen.* The abdomen is characterized by three features: the color of its surface, integrity and consistency. The color of the abdomen is evaluated according to the natural color and the appearance of abnormal color. With the loss of freshness, the abdomen of the fish usually loses its natural pearly white color with a slight pink tint and acquires an intense pink, red and even brown color or becomes discolored.

The color of the abdomen is a characteristic sign of quality for such families of fish as smelt, grayling, gerbil, etc.

The integrity of the abdomen is judged by the degree of damage to the abdominal walls. Abdomen can be intact when there is no damage; slightly crannied if there are cracks, or crannied if there are ruptures without shadding or with guts falling out.

The consistency of the abdomen is determined by feeling and squeezing it with your fingers. Its consistency is assessed as dense, if a high resistance (springiness) of the abdominal tissues is felt during compression; weakened, if weak tissue resistance is felt at the same time; weak, when squeezing the abdomen, significant mobility of its tissues is revealed.

*Anal ring* (additional feature). The anal ring is characterized by color. Determination of the color of the anal ring is carried out for such types of fish as flounder, cod, etc. In fresh fish, the anal ring has a pale pink color, and as the quality of the fish deteriorates, it acquires different colors: red, gray-pink, grayish, gray, dirty green, dirty red.

*Internal organs* (additional feature). Evaluation of internal organs is carried out in doubtful cases, when the benign quality of the fish is difficult to establish without dissection of the abdominal cavity.

The state of the quality of internal organs is judged by two signs: the clarity of the contours and their color, at the same time you should pay attention to the presence of helminths. To determine these signs, the cavity of the fish body is opened with scissors, starting from the anal ring, leading the cutter along the middle line of the abdomen to the beginning of the lower jaw, after which one side wall is removed along with the ribs.

For a better examination of the internal organs, the fish is lowered into a dish with water, while each detail stands out more clearly. Pay attention to the clarity of the contours of internal organs. With the loss of freshness of the fish, the contours of the internal organs become vague, and with further deterioration, the internal organs diverge.

When evaluating the internal organs, the degree of loss of their natural color, darkening or discoloration is also noted.

*Muscle tissue*. Based on the results of the evaluation of the indicators considered above, it is possible to judge only the level of deterioration of the quality of raw fish during storage, but to conclude that it is unfit for use for food purposes there is a thorough examination of the muscle tissue. The quality of raw fish meat is determined by such features as color, consistency and smell. To determine the color and consistency of the meat, make an oblique cut with a sharp knife in the thickest part of the fish. As the quality of the fish deteriorates, the natural color of the meat becomes dull and its spine may turn red.

Consistency is determined by the change of muscle tissue in the cut when pressing on it with the fingers. The consistency can be dense, then the meat springs up significantly and the traces of deformation quickly disappear; weakened - fish meat springs weakly, traces of deformation disappear slowly, but completely; soft - the flesh of the fish does not spring under the fingers, a slight removal of the septa is felt, the depressions formed at the same time

do not disappear completely; smearing - when rubbed between the fingers, the meat is easily smeared.

To determine the smell, a piece of meat cut from the back muscle should be rubbed with the fingers and then you should smell the ground tissue. Additional information about the smell is obtained by sniffing the muscle tissue adjacent to it along the spine, for which the fish is cut in half lengthwise. An incision is made with a sharp knife in the middle of the back from the tail fin to the beginning of the head, exposing the spine. The characteristic smell of fresh fish is clearly pronounced: in some fish it resembles the smell of seaweed, in others - ozone, in others - of freshly picked cucumber, etc. As the quality of the fish deteriorates, the characteristic smell weakens, gradually the meat acquires a characteristic smell of spoilage .

The presence of helminths in the muscle tissue, which is determined visually, can be a sign of reduced quality of fish, which is not related to its freshness,.

### 2.2.2. Frozen fish, fillets and minced meat

The appearance of frozen fish and fillets is determined by the set of features listed in Figure 6.20, frozen minced meat - in Figure 2.2.

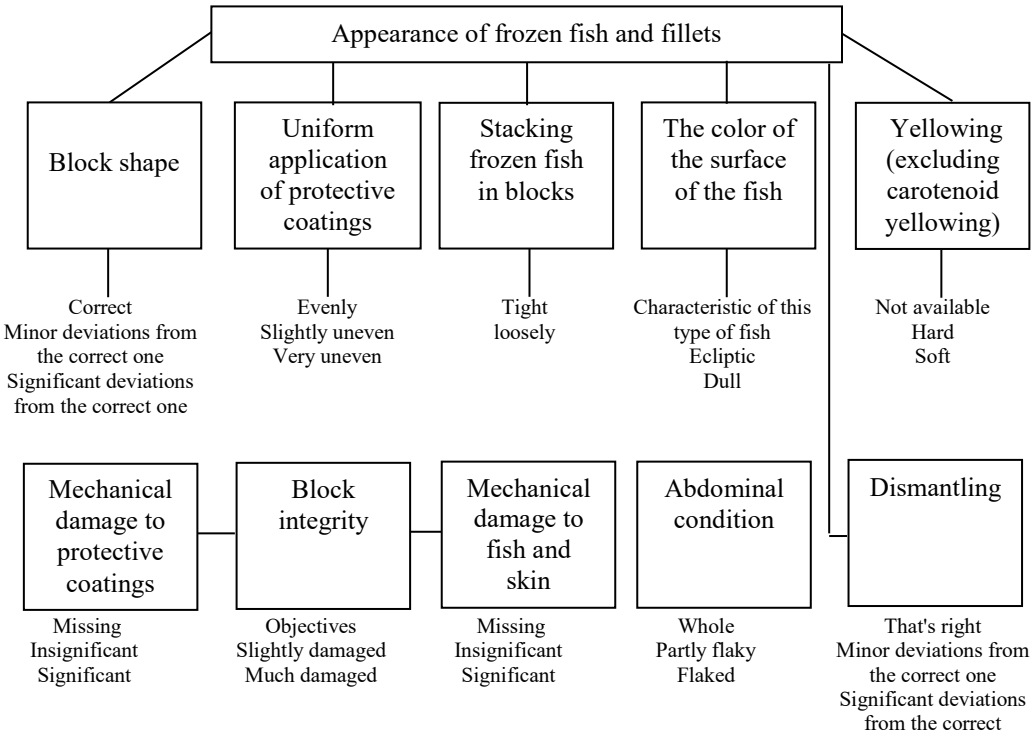


Fig. 2.2. Structural diagram of organoleptic evaluation of the appearance of frozen fish and fillets

The indicators of the appearance of frozen fish products are determined when the samples are in a frozen state and after they are thawed. In the frozen samples, the shape of the block (parallelism of the edges and uniformity of thickness), mechanical damage and uniformity of application of protective coatings, integrity of the blocks, color (only for frozen mincemeat), stacking of fish in the block are determined. The latter is assessed by the density of placement of individual specimens of fish and the presence of voids between them, inspecting a whole or broken block (in the case of loosely packed fish, it is not necessary to apply a significant effort to break it).

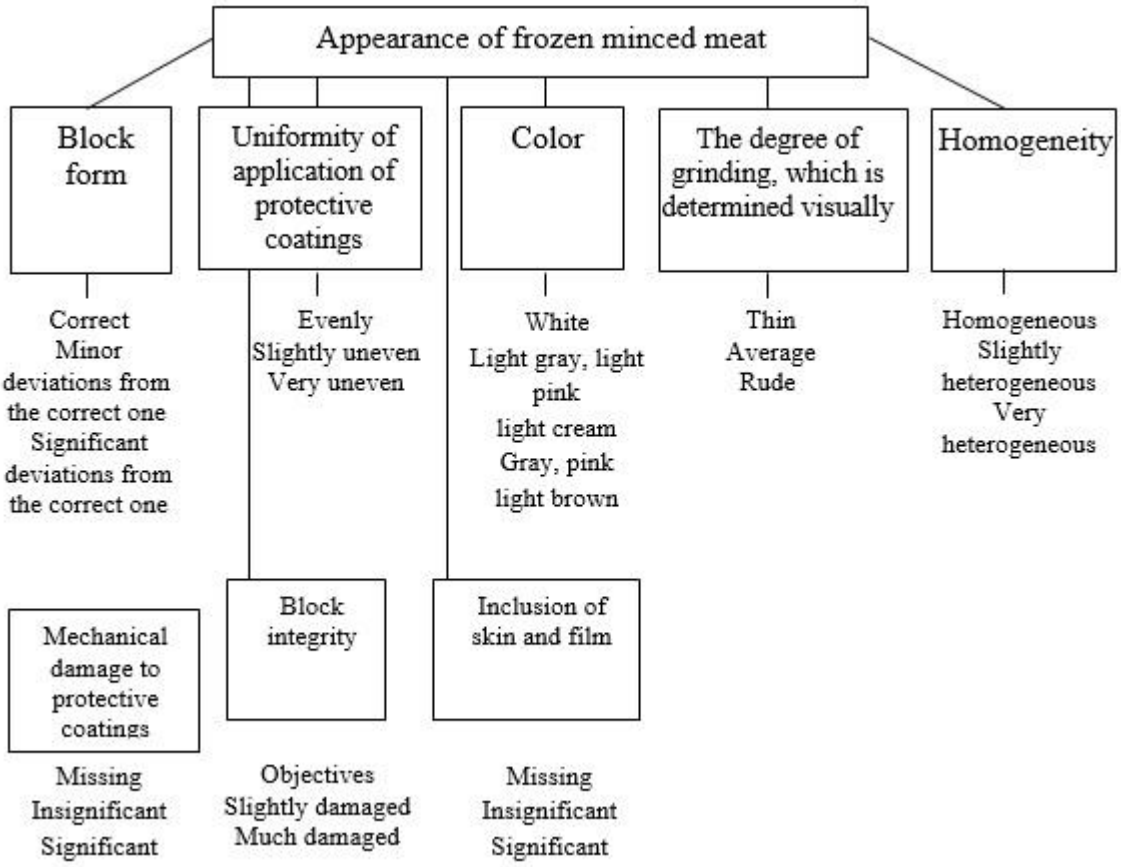


Fig. 2.3. Structural diagram of organoleptic evaluation of the appearance of frozen minced meat

The color of frozen minced meat is characterized by different shades - from white, light gray to pink or light brown. In addition, the absence or presence of darker skin and film inclusions is established.

After defrosting, the following signs of appearance are determined: the presence of mechanical damage to the fish and the skin and scales; the color of the surface of the fish, the condition of the abdomen, yellowing, in some species of fish - obesity; in minced meat after defrosting - the degree and homogeneity of grinding, which are perceived visually.

Samples are thawed in water at a temperature not higher than 15°C or in air at a temperature not higher than 20°C until the temperature in the product layer reaches 0–5°C.

Mechanical damage to the fish body and its scaly covering separately includes injuries, dismemberment marks, bruises, broken fins, skin breakdown, and broken gill covers. Depending on the degree of manifestation, mechanical damage is defined as minor or significant.

In appearance, the degree of preservation of the surface color characteristic of fish and fillets is evaluated, the presence of darkening, yellowing and hemorrhage is noted.

The condition of the abdomen of untreated fish is assessed by its integrity and degree of damage (whole, partially crannied and completely crannied). An intact abdomen can be characterized as firm or weak. The partially crannied belly of frozen fish has a violation of the integrity of the walls in the form of cracks, if completely flaked - a violation of the integrity of the walls without falling out or with the guts falling out.

When evaluating the appearance of frozen fish products, a distinction is made between subcutaneous yellowing of a carotenoid nature, not related to oxidative deterioration of fat, and yellowing caused by fat oxidation. The first is caused by the transition from the skin to the subcutaneous layer of fat-soluble carotenoid pigments and is not a sign of fish spoilage. Yellowing associated with oxidative deterioration of fat is very difficult to distinguish visually from yellowing of a carotenoid nature, so it should be remembered that oxidative deterioration of fat is accompanied by the appearance of a specific smell of oxidized fat, determined after trial cooking (see below), and by a change in the color of fat to dirty yellow with a brown tint, which is not observed in carotenoid yellowing.

To assess yellowing in small fish weighing less than 0.5 kg, the skin is removed from its entire surface, in larger specimens, the skin is removed in places of the most pronounced yellowing. Yellowing of frozen fish and fillets is considered insignificant with a slightly yellowed surface and slight yellowing of the belly. Significant yellowing is clearly expressed in the entire surface, including the abdominal cavity, but it does not penetrate into the thickness of the meat.

When assessing the appearance of thawed fish and fillets, the correctness of disassembly is established. The quality of the fillet is especially carefully evaluated: a properly disassembled fillet should not contain head, shoulder, backbone and large rib bones, fins, entrails, black abdominal film and blood clots, and meat should not be pulled out.

Grinding of minced meat is evaluated as fine (consists of barely noticeable particles that have merged into a single whole), medium (from clearly visible particles), coarse (from large particles). Depending on the degree of uniformity of the size of the minced meat particles, it is described as homogeneous or heterogeneous.

In some types of frozen fish, fatness is determined by the proportions of the anatomical parts of the body and the amount of deposition of adipose tissue in places characteristic for each type of fish.

*Definition of smell*. The smell of frozen fish, fillets and minced meat is characterized, like all fish products and canned goods, by several signs, specifically for frozen products - depending on the degree of preservation of the smell characteristic of this type of product and the presence of the smell of oxidized fat (Fig. 2.4). The smell of frozen fish is determined in different ways depending on the quality.

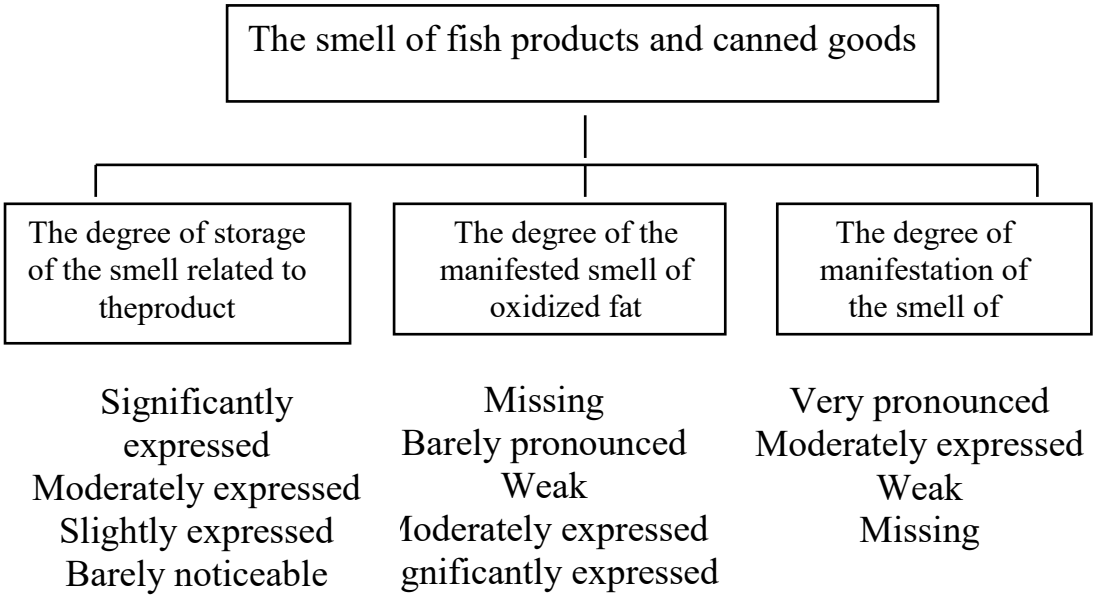


Fig. 2.4. Structural scheme of organoleptic assessment of fish products and canned food by smell

Unthawed fish are examined by a “knife puncture”: a clean, heated knife blade is inserted into different parts of the fish body in the following sequence: between the dorsal fin and the head, near the anus from the side of the abdomen towards the spine, into the insides through the anus, into the places of wounds and mechanical damage. Heat the knife by immersing its blade in boiling water for 1-2 minutes. The blade pulled from the fish is immediately sniffed.

The quality of the smell of thawed fish is determined by a pin test - a pointed cone-shaped stick made of dry, soft and odorless wood. The diameter of the pin in the middle part should be no more than 0.6 cm. The pin is inserted into the same areas of the fish's body as the knife, and in the same sequence. After each sample, the pin must be carefully scraped, and after the examination of each defective specimen of fish, the pin must be replaced with a new one.

Before evaluating the smell of frozen fish, the gills are cut out partially or completely and lowered into hot water to thaw.

The smell of frozen fillets and minced meat is also determined in several ways. A heated knife or a metal pin is inserted into different areas of the block of the unfrozen product, where the smell is determined. After thawing, a block or briquette of fillet or minced meat is cut with a sharp knife, one shoukd bend the sample over and smell it on the cut. When the quality of frozen products is in doubt, the smell after cooking is additionally determined. Before cooking, the fish is washed and processed just like for culinary purposes, large specimens are cut into pieces. The studied samples are immersed in boiling water at a ratio of fish and water of 1:2, cooked at a low heat in a vessel with an open lid until ready (3-12 min depending on the size of the carcasses or pieces). The ratio of the height and diameter of the dishes should provide complete immersion of the samples in water. During the trial cooking and after its completion, the smell of steam, broth and boiled product is determined.

To obtain additional information about the smell, the boiled product is laid out on a plate, separating it from the broth, and both of these components are sniffed in a hot form secondarily.

When determining the smell of frozen fish, fillets and minced meat, attention is paid to the degree of expressiveness of the smell related to the type of fish, as well as to the presence and degree of manifestation of the smell of oxidized fat.

*Determination of consistency*. The consistency of frozen fish and fillets is characterized by one feature - density; it can be dense, weakened, weak, flabby.

The consistency of frozen fish and fillets is determined after they are thawed. To prepare the fish for determining the consistency, a sharp knife with a thin blade makes a transverse cut perpendicular to the backbone of the central, most fleshy part of the body. With the index finger, press on the tissue in the place of the cut. The consistency is judged by the amount of effort required to deform the fabric and the ability to restore depressions formed in

places of pressure. The magnitude of this effort, the speed and completeness of alignment depends on the condition of the fish.

The consistency of frozen minced meat is characterized by four features: density, viscosity, rareness and uniformity (Fig. 2.5). The consistency of frozen minced meat is determined after defrosting it in air under conditions similar to those used to defrost fish and fillets. Density and viscosity are assessed by touch when pressing on the surface of the sample and by rubbing the minced meat between the fingers. At the same time, pay attention to the ability of the product to keep its shape, stick to the fingers and stretch. The rareness of the minced meat is determined by the ease of separation of the liquid from the minced meat when pressing on the surface of the test sample, and the uniformity of grinding is determined by examining a fresh cut of the minced meat and rubbing the sample between the fingers.

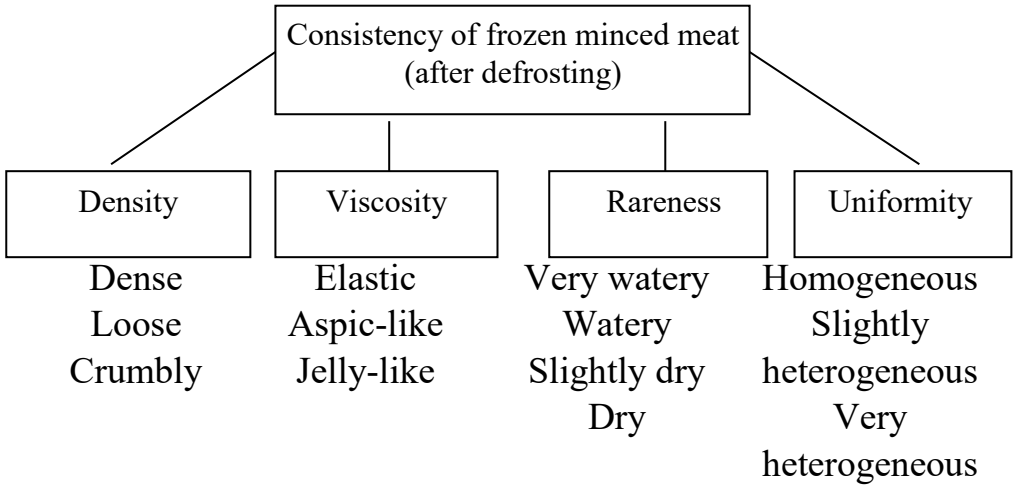


Fig. 2.5. Structural diagram of the organoleptic evaluation of the consistency of frozen minced meat

The conclusion about the consistency of minced meat is made based on the following definitions: it is considered dense if it does not change shape and springs when pressed with force on the surface of the briquette; loose - if the briquette easily falls apart into irregularly shaped pieces; crumbly - if the touch with a slight effort

is accompanied by the division of the minced meat sample into lumps.

According to the viscosity, the consistency of minced meat can be estimated as elastic, when a significant effort is required to compress the sample; aspic-like, if the minced meat is a mass that does not spread; jelly-like, if the minced meat has the appearance of a thick, spreadable mass, sticky to the touch.

The water content of minced meat is assessed by the ease of liquid separation from the samples when they are compressed.

### 2.2.3. Salted fish

The appearance of salted fish is determined by the signs indicated in Figure 2.6.

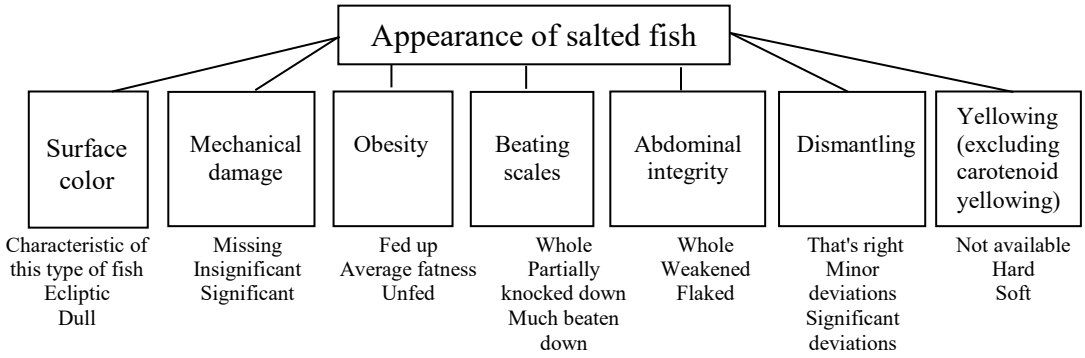


Fig. 2.6. Structural scheme of organoleptic assessment of the appearance of salted fish

The color of the surface of salted fish is evaluated by the gloss and characteristic of the coloring. The normal fish covering has to be shiny, clean, light or dark depending on the specific characteristics of the species. In some cases, a slight darkening of the surface of the fish with a weak yellowish tint on it and cuts, as well as the absence of a silver layer, the presence of minor bruises, pigmentation in the form of spots, stripes, and sediment of protein substances is allowed.

When assessing mechanical damage, pay attention to skin breaks, spinal fractures, head injuries, cuts and punctures, broken gill covers, tears in meat tissue, bruises, scratches. Minor injuries include scratches, punctures, traces of decoration in the absence of meat damage, small skin tears. Significant injuries are: damage to the head, broken gill covers, bruises, bites.

Indicators of the appearance of salted fish also include its fatness, the integrity of the abdomen, and the loss of scales. The degree of yellowing of salted fish is evaluated in the same way as frozen fish.

*Definition of smell.* The smell of salted fish is examined by smelling its surface or meat on a transverse cut made with a knife with a thin blade in the middle, most fleshy part of the fish body, or by piercing the body of the fish in several places with a wooden pin and smelling it.

The smell of salted fish is evaluated by the intensity of its characteristic aroma and typicality for this method of processing; the presence of a very original and harmonic bouquet, characteristic of ripe fish, as well as the presence of the smell of oxidized fat.

A salted, ripe fish should be considered one that does not have the smell of dampness, but a rich, very distinctive, harmonic and very spicy aroma.

When examining spicy and marinated fish, in addition to the signs that are determined when evaluating the smell of salted fish, the intensity of the smell of spices and acetic acid is revealed. The smell of some types of spices should not stand out. For certain types of salted fish, the presence of a weak muddy or iodized smell, as well as a sour smell in the gills, is allowed.

*Definition of taste.* The taste of fish products and canned food, including salted fish, is evaluated according to general main indicators (Fig. 2.7).

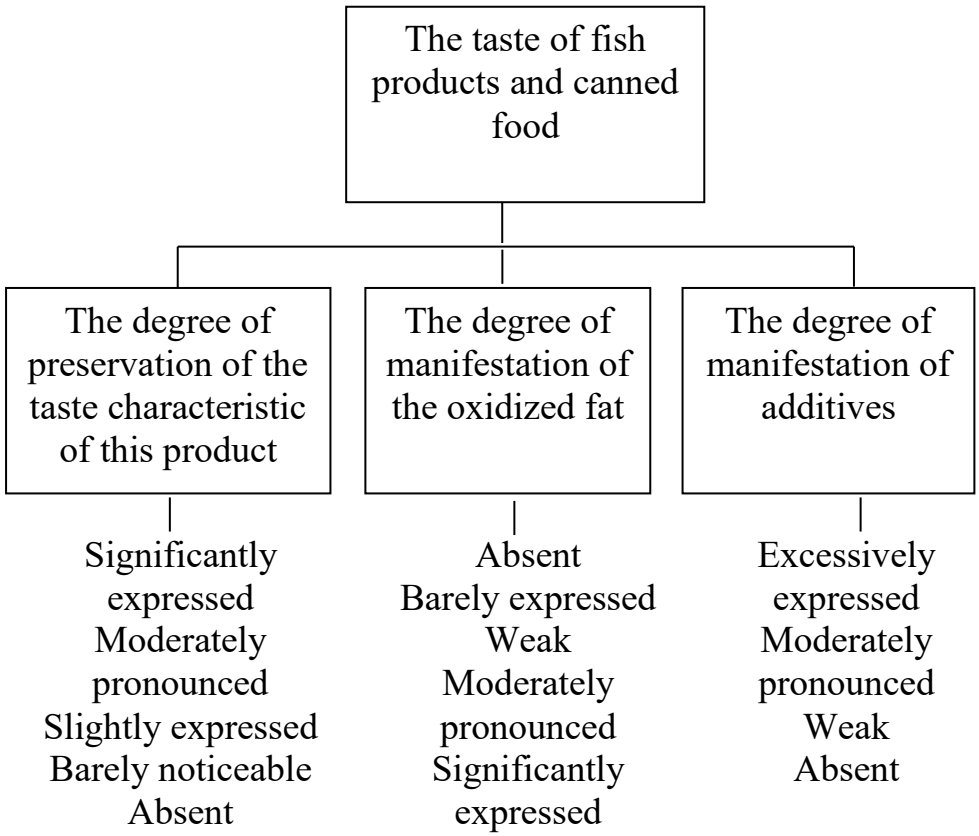


Fig. 2.7. Structural scheme of organoleptic evaluation of the taste of fish products and canned food

The taste of salted fish is determined by directly testing samples of the product, cut into thin slices and thoroughly chewing them.

The test sample is cut with a sharp knife from the middle, most fleshy part of the fish carcass perpendicular to the backbone. The thickness of the cut slices should be no more than 1 cm, and the temperature of the samples should be about 20°C.

The taste of salted fish is evaluated by the level of its expressiveness, characteristic of this type of raw material and this method of processing, the presence of a characteristic, very pleasant rich taste of ripe fish and the aftertaste of oxidized fat. When researching the taste of spicy and marinated fish, in addition to the

mentioned two signs, the intensity of the taste of spices and acetic acid is also determined.

*Determination of consistency*. The consistency of salted fish is characterized by density, juiciness and tenderness (Fig. 2.8).

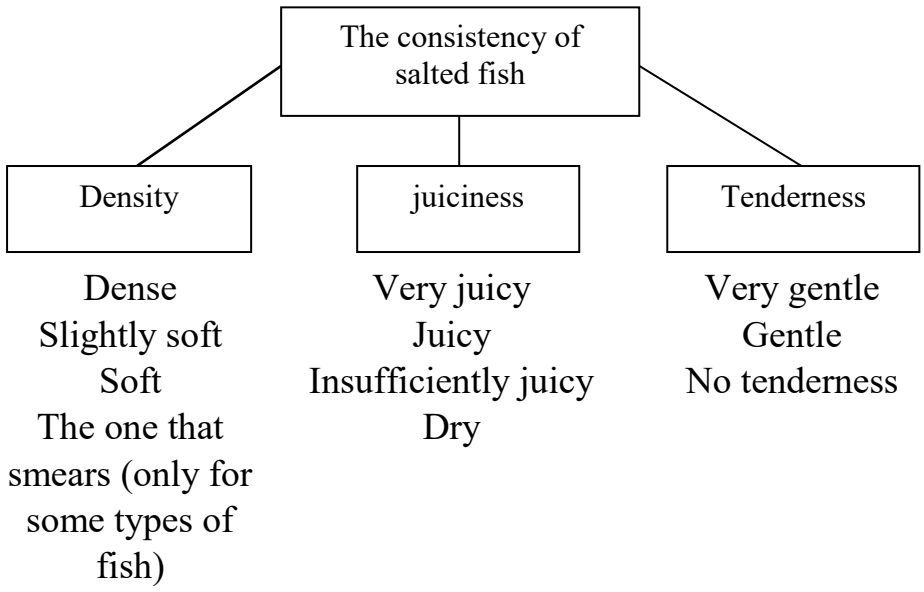


Fig. 2.8. Structural diagram of organoleptic assessment of the consistency of salted fish

Density is determined by palpation of fleshy parts, pressing, as well as chewing, simultaneously with the determination of taste. The density is assessed by pressing on a cut made with a sharp knife with a thin blade perpendicular to the backbone in the middle, most fleshy part of the fish's body.

For small fish weighing 100 g and less, press with your fingers along the back of the fish.

Sections of the dorsal muscle, taken in the cross-sectional area, are used for chewing. Depending on the properties of a specific product and practical need, one, two or all three methods are used.

When determining the density, attention is paid to the product's resistance to pressing and chewing. To determine juiciness, the fish is chewed and at the same time focusing on the ease of separation of tissue juice and its amount, as well as on the

degree of wetting of the oral cavity with it. To assess tenderness, the sample is not chewed, but squeezed between the tongue and the front part of the palate. At the same time, attention is focused on the ability of the tissue to easily transform into a homogeneous mass, suitable for swallowing, which does not cause mechanical irritation of the oral cavity.

For some types of salted fish, layered meat, hard or weak consistency is allowed.

### 2.2.4. Cured and dried fish

The appearance of cured and dried fish is determined by the signs indicated in Figure 2.9. The surface characteristic of cured and dried fish is bright, clean, silvery, but it can be partially or completely tarnished or tarnished in various places. The yellowing of the subcutaneous layer is determined after removing the skin from the entire surface of the fish, as well as by examining the sections on the belly of the dissected fish.

When evaluating the appearance of cured and dried fish, the presence of salt in the form of a white coating may be seen. One of the important signs of the appearance of cured and dried products is the brokenness of the scales. Fractures of the gill covers, punctures, cuts, and small skin tears are possible from mechanical damage.

In cured and dried fish prepared from unprocessed raw fish, the density of the abdomen is evaluated; it can be dense, weak, with a slight violation of integrity. If the fish is cured or dried in a processed form, then its inner surface should be cleaned of black film, blood, and the cuts should be even, without the meat sticking out. When assessing the appearance of cured and dried fish, the degree of surface hydration is monitored. A surface on which condensed water is visible is considered wet.

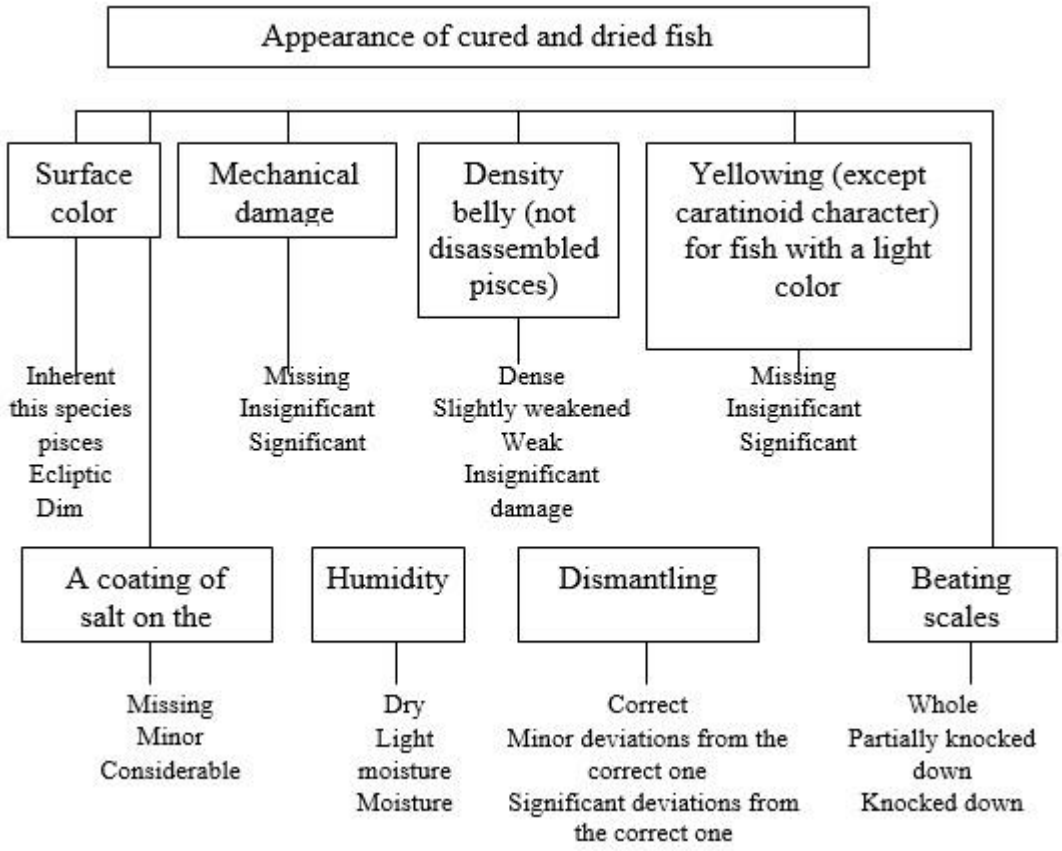


Fig. 2.9. Structural diagram of organoleptic evaluation of the appearance of cured and dried fish

*Definition of smell.* The smell of cured and dried fish is examined by sniffing the surface of the product or fish meat on a cross section made with a knife with a thin blade in the middle part of the fish body, or by using a sample on wooden pins. The technique of its determination is similar to the technique of determining the smell of frozen fish.

In some cases, the smell of dried small fish is determined by sniffing after strong compression of several specimens of fish in a handful, which causes partial crushing.

The smell of dried fish is assessed by the intensity of the smell related to given species and typical for this method of fish processing, as well as the presence of the smell of oxidized fat.

When dried fish ripens, there is no smell of dampness, and there is a peculiar, harmonic smell related to dried products. Dried fish does not have the smell of a ripe product.

*Definition of taste.* The taste of cured and dried fish is determined in the same way as the taste of salted fish.

*Determination of consistency.* The consistency of cured and dried fish is characterized by hardness, stratification and oiliness (Fig. 2.10).

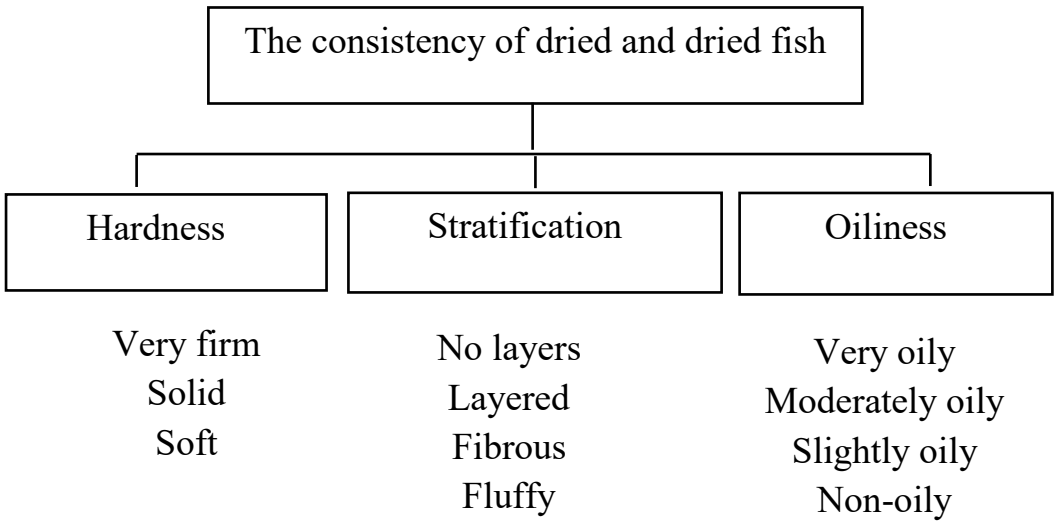


Fig. 2.10. Structural diagram of organoleptic evaluation of the appearance of cured and dried fish

Firmness is determined by squeezing the dorsal part of the fish body with the fingers and tasting pieces of meat taken from the dorsal muscle near the head; layering - by examining the structure of the tissue at the crack in the middle part of the fish's body, paying attention to the ease of separation of the longitudinal fibers of the meat from each other. Oiliness is assessed to the touch by rubbing pieces of meat between the fingers, taken from the back muscle near the head, and tasting them, while noting the amount of fat in the tissue and the uniformity of its distribution.

### 2.2.5. Smoked fish

*The appearance* of hot and cold smoked fish is evaluated according to the signs indicated in Figure 2.11.

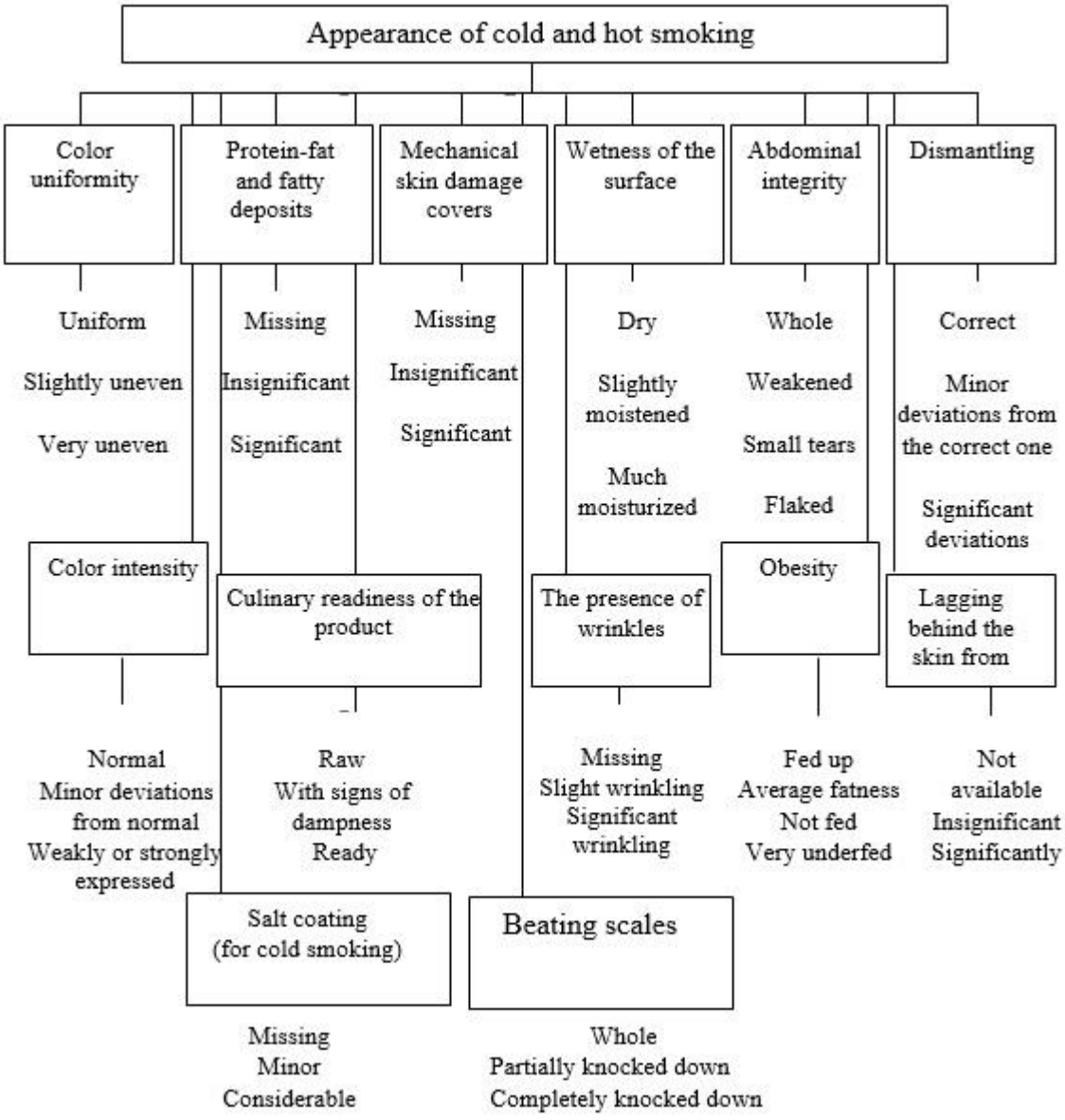


Fig. 2.11. Structural scheme of organoleptic assessment of the appearance of cold and hot smoked fish

During the external inspection of smoked fish, the uniformity and intensity of its color are evaluated. The uniformity of the color is characterized by the presence of light spots caused by incomplete surface treatment with smoke, skin burns, rod marks and soot contamination. Light golden to dark golden with a silver tint is considered normal in intensity, but the color can be dark depending on the natural color of the fish's skin.

The appearance of smoked fish is also evaluated by the presence of protein-fat deposits in the form of separate spots, narrow strips occupying different areas. Depending on the degree of deposits, this sign is characterized as insignificant or significant.

Excessive salt may manifest as a white coating on various parts of the body, including the head, gill covers, and tail fin. Mechanical damage to smoked fish includes harm to gill covers and fins, punctures, small breaks and cuts in the skin, cracks on the slices and the abdominal cavity, broken or fractured heads, and cut wounds. The appearance of smoked fish is also assessed based on fatness, battered scales, skin wrinkling, its distance from the meat, surface moisture, belly integrity, and the correctness of processing.

The belly of whole smoked fish may be intact, weak, or exhibit burst cracks. A dense abdomen without tissue damage is considered intact, while a ruptured abdomen may have broken abdominal walls, leading to the spilling of entrails.

The culinary readiness of hot-smoked fish is assessed based on its appearance. In the finished product, blood, meat, caviar, or milk should be completely coagulated, boiled, without signs of moisture, and the meat should easily separate from the backbone.

The smell and taste of both cold and hot smoked fish are determined in the same way as with salted fish. Smoked fish is allowed to have a bitter aftertaste from resinous substances in the smoke, as well as a sour aftertaste in oceanic fish.

*Determination of consistency*. The consistency of cold and hot smoked fish is characterized by such features as density, juiciness and tenderness (Fig. 2.12, 2.13).

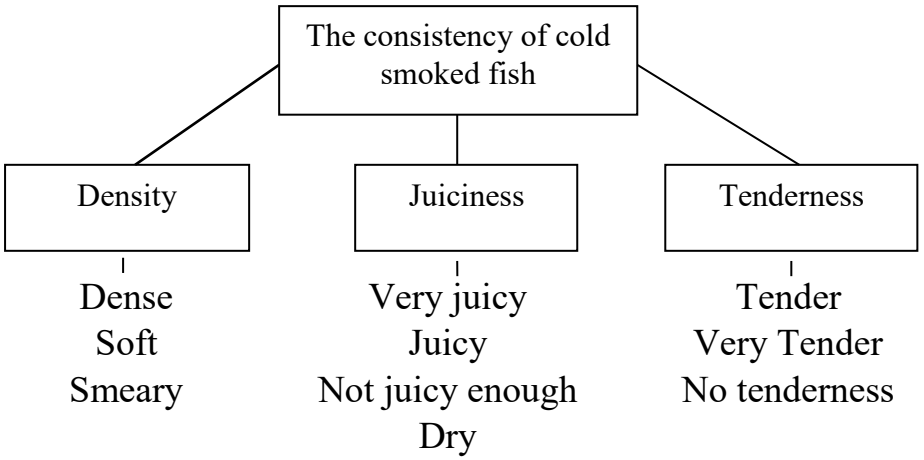


Fig. 2.12. Structural diagram of organoleptic evaluation of the consistency of cold-smoked fish

For hot smoked fish, such an indicator as fragility is also determined.

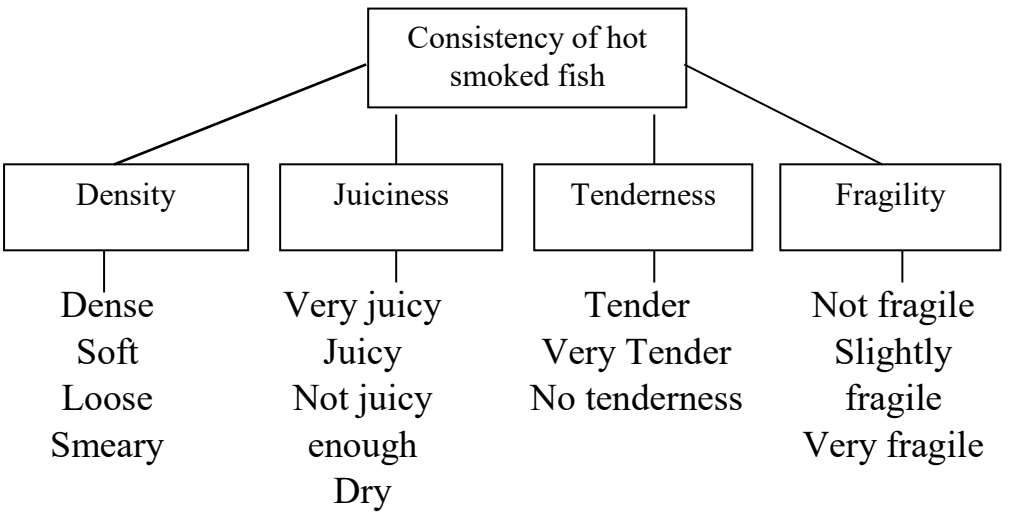


Fig. 2.13. Structural diagram of the organoleptic assessment of the consistency of hot smoked fish

Density is assessed by feeling the whole fish with your fingers along the back, pressing on the meat in a cross-section that passes through the most fleshy part of the fish's body, and chewing slices of back muscle taken in part of the cross-section. When examining fish smoked in pieces, pressing is carried out in the most fleshy areas and on the ends of each piece.

Juiciness and tenderness of smoked fish are determined by testing it in the same way as salted fish.

To determine fragility, a large hot-smoked fish is cut in the transverse direction with a sharp knife, while a small one is broken in the middle part of the body.

### 2.2.6. Canned food

In canned fish, the appearance of the solid (Fig. 2.14) and liquid (Fig. 2.15) parts is determined separately.

The indicators of the appearance of the hard part of the canned goods, such as stacking, evenness of the cut, the protrusion of the backbone above the level of the meat, the color of the meat, its sticking to the inner surface of the can, and the presence of curdled protein, are evaluated before removing the contents from the can. Additional information about these and other indicators is obtained when examining the product laid out in dishes for sensory analysis.

The opinion about the appearance of the hard part of the canned food, compiled based on the evaluated characteristics, is compared with the verbal description given in the regulatory documentation for the corresponding type of canned food. The size of fish pieces is estimated by comparing their height to the inner height of the can, while the size of fish carcasses and minced meat products is assessed based on the uniformity of the size of individual specimens. The color of the meat is determined by examining the surface and the fracture of pieces or carcasses made in the transverse direction relative to the vertebral bone.

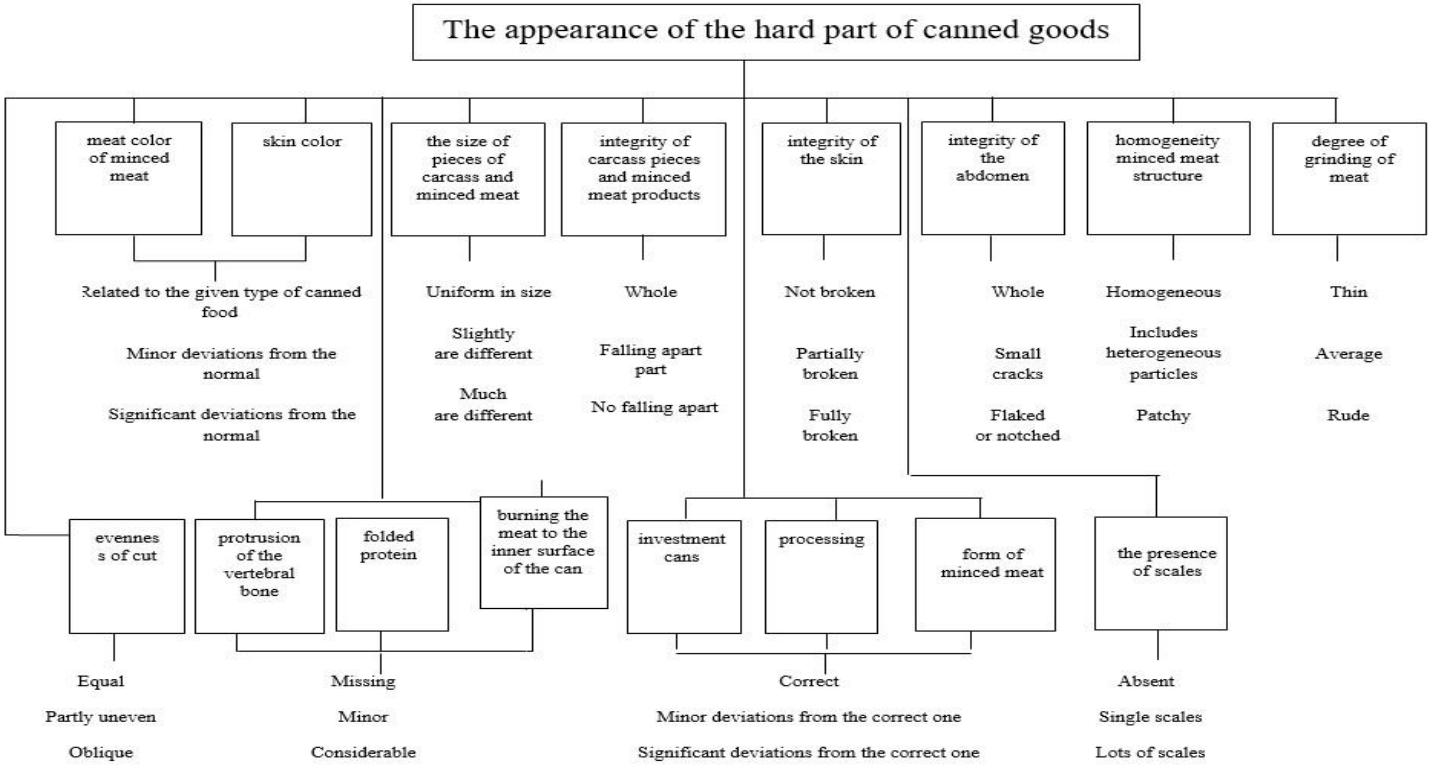


Fig. 2.14. Structural scheme of organoleptic assessment of the appearance of the hard part of canned goods

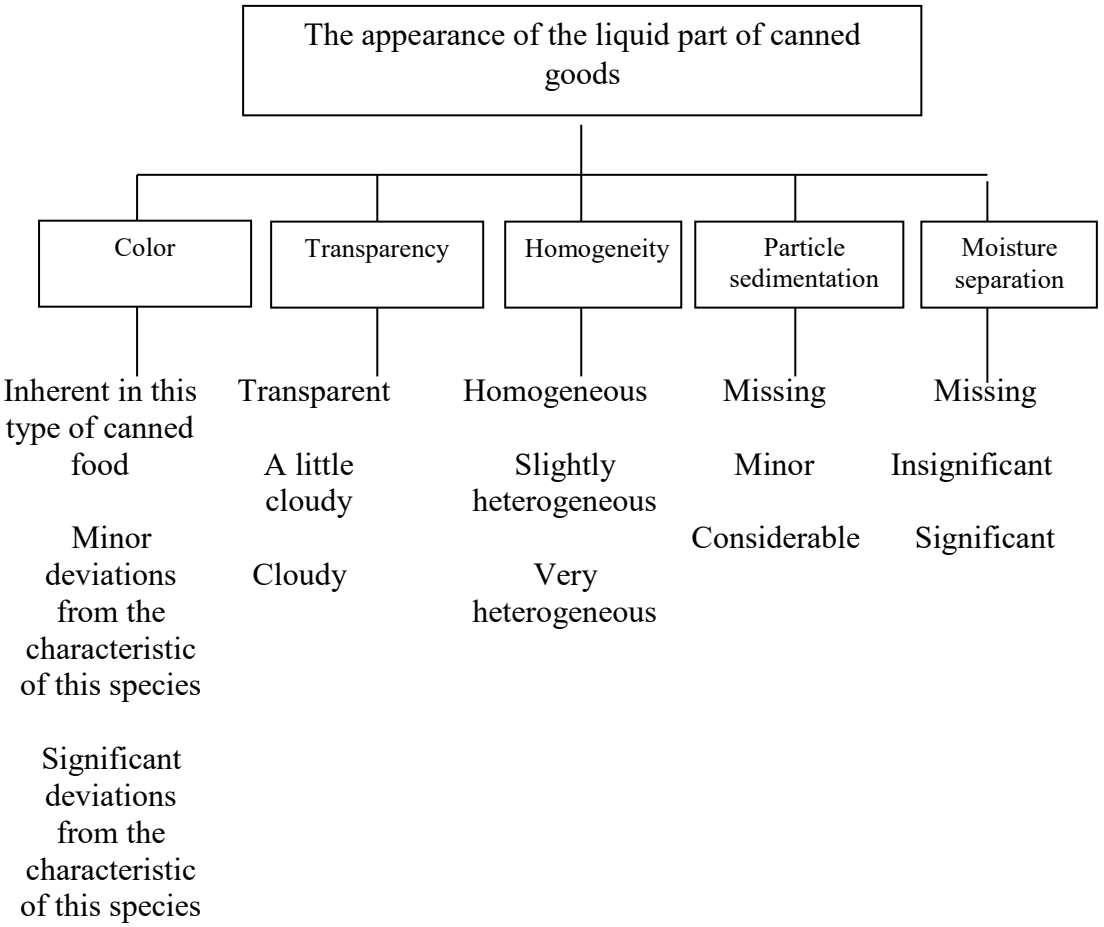


Fig. 2.15. Structural diagram of organoleptic assessment of the appearance of the liquid part of canned food

Such signs of the appearance of the hard part of canned goods, such as correctness of shape, uniformity of structure, and degree of grinding, are determined only for canned goods made from minced meat. When evaluating the homogeneity of the structure and the degree of grinding, as well as the color of minced meat products, they are broken into the thickest part, and the surface of the fracture is inspected.

When determining the signs of the appearance of the liquid part of canned fish, the filling is poured into a colorless glass, and the liquid is viewed through transmitted light. The transparency of

the oil in canned fish is evaluated under transmitted light on a white background after allowing the oil to settle in a measuring cylinder for 24 hours at a temperature of 20°C.

*Definition of smell*. The smell of canned goods is determined by sniffing their contents immediately after opening the can and after putting it on a plate, paying attention to the intensity of the smell characteristic of this assortment of canned goods, as well as the level of manifestation of the smell of additives.

*Definition of taste*. The taste of canned goods is determined in three stages: first the solid part, then the liquid part, and finally, the overall taste after combining these components.

When determining the taste of canned food, attention is focused on the intensity of the taste characteristic of this type of fish and typical for this method of processing, as well as the intensity of the manifestation of the taste of additives.

*Determination of consistency*. The consistency of the solid part (pieces and carcasses of fish, minced meat) is characterized by density, juiciness, and tenderness (Fig. 2.16).

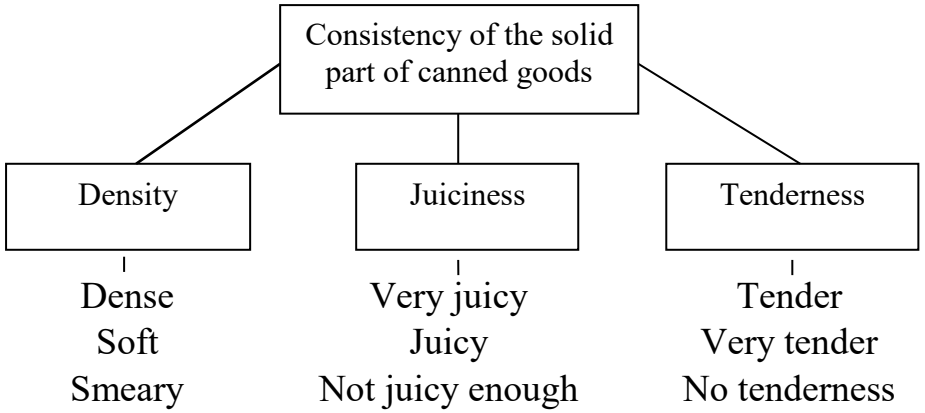


Fig. 2.16. Structural scheme of organoleptic assessment of the appearance of the hard part of canned goods

The density is determined by lightly pressing the flat side of the fork on the middle of the side surface of a piece, fish carcass or minced product, as well as when chewing. Juiciness and tenderness

are assessed only when chewing. Such a single indicator of consistency, as tenderness, is related to a limited type of canned food, for example, herring, sardine, saury, omul etc. In some types of canned goods, the consistency of the bones is determined, which varies from soft, easily chewed to hard.

### 2.2.7. Invertebrates and their products

The organoleptic characteristics of the quality of invertebrates differ from those of fish. They have a wide range of single indicators related to each type of molluscs and crustaceans and are additionally determined by the processing method.

The characteristics of the organoleptic properties of invertebrates and products from them are reflected in numerous scientific works and regulatory documents, but this information is not systematized due to their fragmentation, the large number of animal species and the range of products from them.

The object of organoleptic assessment of fresh invertebrates is often not whole animals, but their edible parts that are sent for processing after full or partial disassembly in fishing.

Below, as an example, the gradation of organoleptic features of some invertebrates is given.

The structural scheme characterizing the skin of a squid reflects numerous and peculiar single signs (Fig. 2.17), which change significantly depending on the postmortem state (Table 2.39) and are used in the study of the degree of freshness of raw materials.

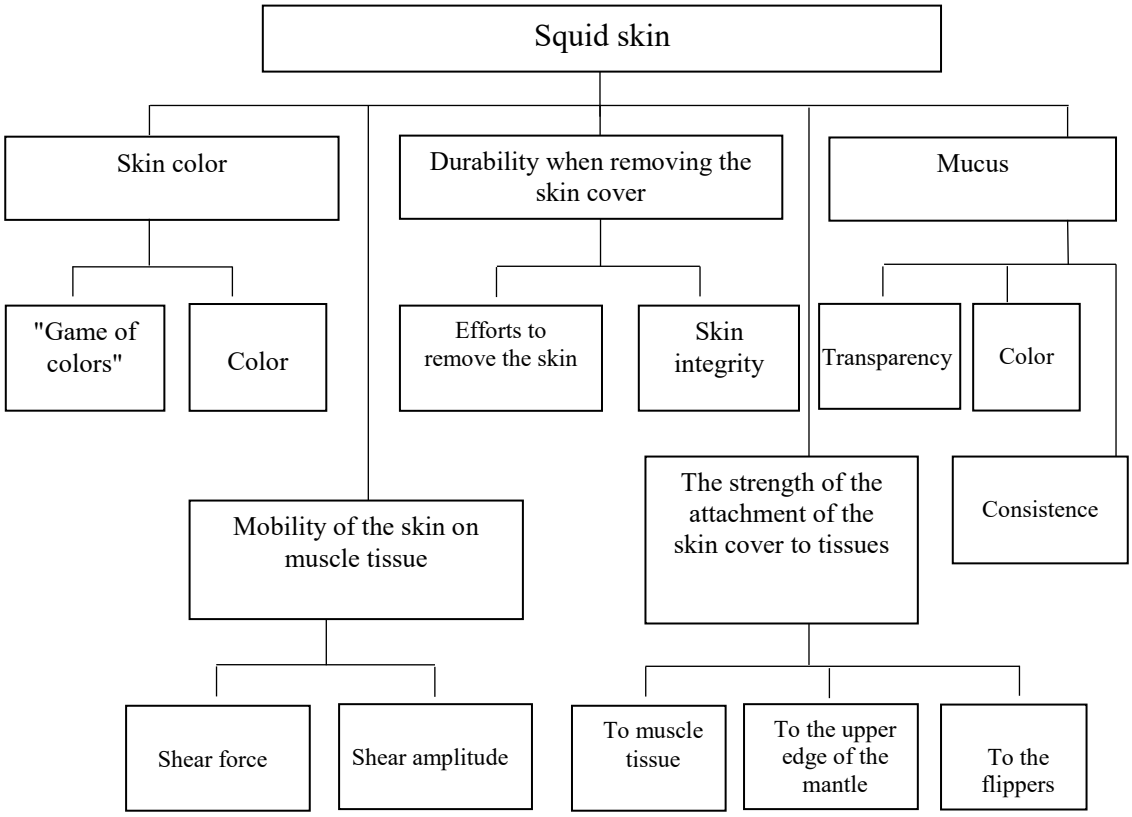


Fig. 2.17. Structural scheme of organoleptic features that characterize the skin of raw squid

The verbal description of the quality of boiled-frozen peeled shrimp includes more than 40 single indicators of different levels of consideration, the main ones are listed in the table

**Table 2.39. Verbal description of the quality of boiled-frozen peeled shrimps**

| Color | Taste | Scent | Consistence |
|---|---|---|---|
| From yellowish | Specific | Fresh | Fragile |
| to red | Fresh | Dehydrated product | Juicy |
| | Foreign | | Granular |
| | "Factory" | Ammoniac | From good to bad chewing |
| | Fishy | | |
| | Potato | | |
| | Stale | | |

The development of mariculture and the sale of invertebrates in fresh form, the increase in the production and consumption of their processing products will require the expansion of sensory research.

**Questions for discussion and self-examination**

1. Name the main organoleptic indicators that characterize the quality of individual organs and tissues of raw fish
2. Name additional signs that characterize the quality of individual organs and tissues of raw fish
3. How is the color of the scaly skin determined?
4. How do you evaluate fish gills?
5. Name three signs that characterize the belly of a fish
6. By what signs is the quality of internal organs judged?
7. How do you evaluate the appearance of frozen fish products?
8. What does the yellowing of frozen fish and fillet indicate?
9. How to determine the smell of fish correctly?
10. What are the indicators of the appearance of salted fish?
11. What are the characteristics used to determine the appearance of dried and dried fish?
12. What are the characteristics of the appearance of smoked fish?
13. Name the indicators of the appearance of the hard part of canned goods
14. Name the indicators of the appearance of the solid part of canned goods
15. Describe the organoleptic properties of invertebrates and their products

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## GLOSSARY OF TERMINOLOGY

**Adaptation** - decrease in sensory sensitivity during prolonged exposure to a taste or smell stimulus

**Aversion** - rejection of a food product due to the subjectivity of sensations, unpleasantness of its organoleptic properties

**Ageusia** - the complete absence of person's sense of taste

**Agnosia** - lack of taste sensitivity to all taste substances, to one substance, or to a group of substances

**Allesthesia** - changes in the positive assessment of a food sample depending on the state of the evaluator's body

**Anosmia** - condition in which a person's odor detection threshold is below the minimum value

**Aroma** - pleasant smell

**A single product quality indicator** - an indicator that characterizes one of its properties: moisture content in %, acidity in degrees, tea taste in points, etc.

**Aromatic substance, odorant** - any substance that can cause olfactory sensations;

**Aroma of a meat product** - pleasant characteristic smell of a meat product

**Aromatic number** - the ratio of the concentration of an odorous substance in a product or solution to its threshold concentration in them

**Audio method** - method based on the perception of sounds by the hearing organs

**A stimulus** - an irritant affecting receptors; stimuli are of various modalities: light, sound, mechanical, chemical, etc.

**A specialized expert** - an expert tester who has experience working with any product and/or is familiar with the production technology of this product and/or marketing of this product, is able to perform its organoleptic analysis, evaluate or predict the effect of changes in the composition of raw materials, formulation, conditions production, storage, product aging, etc.

**Acidity** - the organoleptic property of individual substances or mixtures to cause a sour taste

**A complex indicator of product quality** - an indicator that characterizes several of its properties (for example, a commercial grade of cheese), such an indicator characterizes several simple properties or one complex one: bread crumb quality is a complex indicator characterized by a number of single ones: color, porosity, elasticity, etc.

**Appearance** - the general visual sensation that the product creates

**A control sample of a meat product** - a sample of a meat product used as a basis for evaluating the quality of meat products of this type

**A stimulus** is a substance or electrophysical influence that causes a sensation when interacting with chemoreceptors

**A test sample of a meat product** - sample of a meat product that is used to assess its quality

**Acid smell** - this smell does not coincide with the concept of acid, since it is also characteristic of camphor and acetone

**Alkaline taste** - a sensation for which a typical stimulus is a water solution of sodium bicarbonate

**Alkalinity** - the organoleptic property of individual substances or mixtures to cause an alkaline taste

**A trained tester -** a person who meets the established criteria and norms and has previously participated in organoleptic analysis

**A microsensor** - a sensor manufactured using the technology of integrated circuits or microelectromechanical systems, with an electrical output signal

**An untrained tester** is a person who does not need to meet the established criteria and norms

**Acceptability of the product** - property of the product to be acceptable to an individual or population from the point of view of organoleptics

**A product** - an edible or inedible substance that is the object of organoleptic assessment

**Aftertaste** - the olfactory sensation that appears after swallowing or removing the product from the oral cavity, which differs from those sensations that were perceived when the product was in the oral cavity

**Astringent taste** - a sensation for which a typical stimulus is a water solution of tannins

**Astringency** - a feeling of touch, caused by the fact that the inner surface of the oral cavity contracts and at the same time dryness appears in the mouth

**Aftertaste** - the sensation left after the removal of the taste stimulus, qualitatively identical to the initial sensation or modified

**A flavorist** is a specialist who studies methods of forming and preserving the flavor of food products and possesses a set of knowledge about the physico-chemical nature of smell and taste, about organoleptics and methods of keeping flavoring compositions, and about legislation on food additives.

**Brittleness** - the property of a solid product to crumble during biting and chewing, due to a weak degree of cohesion between particles

**Bitter taste** - a sensation for which typical taste stimuli are water solutions of caffeine, quinine and some other alkaloids

**Basic indicators** - indicators taken as a basis during the comparative characterization of quality indicators: an example of a basic indicator can be the color of the standard, which corresponds to the color of flour of a certain grade

**Bouquet** - a smell formed as a result of combining the aroma typical of the product and harmonically combined nuances acquired as a result of additional processing of the product.

**Bitterness** - organoleptic property of individual substances or mixtures that causes a bitter taste

**Closed tastings** are held in rooms equipped with individual booths

**Consumer** - a person who uses a product

**Correctable deficiency** - all defects which are recoverable

**Color** - an impression caused by a light pulse and determined by the dominant light wavelength and intensity

**Competence** - professional competence - knowledge of technological features of product manufacturing, values of quality indicators of analogues, prospects of product development, mastery of marketing issues; qualitative competence – a clear understanding of the principles and methods of evaluating the quality of products (the ability to use rating scales, knowledge of the principles of their construction, the ability to distinguish a sufficient number of gradations of the quality of the evaluated object)

**Convergence** - the ability of a person to look in different directions, rotate the eyes, six muscles surrounding the eyes help to get one image, although a person looks with two eyes

**Consistency** - a touch that perceives the density, stickiness of the product, pressure force; it is felt when the product is distributed on the tongue (consistency is liquid, syrupy, thick, dense)

**Caprylic** - the smell of fescue oils, also characteristic of gasoline, kerosene and rancid fats

**Conformism** - the effect of imposed judgment, external and internal agreement with a group or another person, without experiencing internal conflict or with experiencing it; often interpreted as imitation, unwillingness to stand out from the group. The concept of conformism means adaptation, passive acceptance of dominant opinions

**Consumption of the product** - use of the product by the consumer as intended to satisfy a certain need

**Consumer property of the product** - property of the product that determines its usefulness and ability to satisfy the needs of consumers and is manifested in the process of consumption

**Consumer qualities of the product** - a quantitative characteristic of one or more properties of the product, which is considered before the conditions of consumption

**Consumer research** - organoleptic research with the involvement of consumers to evaluate the properties of a new product or a traditional product that is produced in several variants and has gone on sale

**Defect** - a product, the transfer of which to the consumer is not allowed due to the presence of flaws

**Dense consistency of a meat product** - the consistency of a meat product characterized by a relatively large mass per unit volume and closely connected particles

**Determining indicators** - indicators that are of decisive importance when evaluating the quality of goods

**Distinction** -quantitative and/or qualitative difference between two or more stimuli

**Daltonism** - lack of ability to distinguish colors

**Dichromatism** - disease that occurs in people with a partial loss of the ability to distinguish colors: instead of the three main ones, they distinguish only two

**Dysgeusia** - violation of taste perception, when a substance with a pleasant taste seems tasteless

**Deterioration of product quality** - a decrease in the level of product quality caused by defects in raw materials, as well as a violation of production technology

**Descriptive method** - an organoleptic method of quality assessment of each of the separately considered properties of a food product using a list of their quality characteristics (descriptors), standardized or non-standardized

**Deliciousness** a complex sensation that occurs when tasting food in the mouth, and taste is only a component of the product's deliciousness

**Expert** - a person who, due to his knowledge or practical experience, is competent to express his opinion in the field in which he/she is consulted

**Expert** - tester in the field of organoleptic analysis (expert sensory assessor) - a selected tester who has demonstrated high sensory sensitivity, has special training and experience in organoleptic tests and is able to give well-reproducible results of organoleptic evaluations of various products

**Expert** - in the broadest sense of the word, is a person who has relevant knowledge, experience and competence and gives a conclusion when considering any issue

**Expert taster** - a selected tester with high sensory sensitivity and experience with organoleptic evaluation methods, capable of analyzing various products with a high degree of reliability and reproducibility

**Exploitation of the goods** - the use by the consumer of non-food goods for their intended purpose in accordance with the rules of operation

**Elasticity** - a characteristic of texture as a property of a food product, determined by the speed and degree of recovery of the product's original dimensions after the termination of the deforming effect

**Efficiency** - composure, validity of judgments, confidence, interest in work; other necessary indicators are also observability, a tendency to overestimate or underestimate estimates compared to the majority of estimates

**Fibrosity** - an impression caused by fibers that provide resistance during chewing of a product, which can be felt qualitatively and quantitatively (for example, meat with thin fibers)

**Fatigue** is explained by too slow regeneration of the functional abilities of the organ of smell

**Floral smell** - characteristic mainly of flowers, but also characteristic of other substances

**Food additives** - synthetic and natural substances that are specially introduced into food products to improve the technological process of production, their structure, physico-chemical and organoleptic properties, increase the shelf life of raw materials and products, increase their biological and nutritional value

**Food taboo** - food prohibition related to religious beliefs, superstitions, medical indications

**Food flavoring** - a taste-aromatic mixture introduced into food products as a food additive to improve organoleptic properties

**Food intensifiers** - substances introduced into food products only to enhance their inherent aroma and taste

**Flavor or deliciousness** - a complex sensation of taste, smell and

touch during the distribution of the product in the oral cavity - is determined qualitatively and quantitatively

**Form** - a combination of geometric properties (proportions) of the product

**Formation of product quality** - establishing and maintaining the socially necessary level of product quality at all stages of production and delivery to the consumer.

**Gloss** - the product's ability to reflect most of the rays falling on its surface, depending on the smoothness of the product's surface

**Human saliva** - a complex combination of inorganic phosphates, carbonates, sulfates, chlorides and organic food enzymes (amylase), proteins, etc.

**Hearing** is a person's ability to perceive sound and navigate with the help of a hearing analyzer in the environment

**Hard consistency of a meat product** - a consistency of a meat product characterized by increased resistance to chewing and (or) deformation

**Hypergeusia** - increased taste sensitivity

**Hyperosmia** - painful aggravation of the sense of smell

**Hypogeusia** - reduced taste sensitivity to all taste substances, or to one substance, or to a group of substances

**Hyposmia** - reduced olfactory sensitivity to all odorous substances, or to one substance, or to a group of substances

**Hedonic** - related to liking or disliking something

**Homogeneity** - the feeling of touch produced by the size of the product particles (homogeneity of chocolate mass, candy fillings)

**Irreparable defect -** a defect in which at least one of the issues is irreparable

**Individual reproducibility of assessments** - the ability of the same subject to obtain identical results during repeated analysis of the same product, which is carried out under the same conditions, but at different times

**Integral quality indicator** - determined from the ratio of the total beneficial effect from the operation or consumption of products to the total costs of its creation, operation or consumption

**Intensity** - the degree of perception; quantitative characterization of the stimulus causing perception

**Improving the quality of the product** - an improvement in the quality of the product, which makes it possible to more comprehensively and fully satisfy the corresponding need

**Juiciness** - the impression produced by the juices of the product during chewing (for example, the product is juicy, not juicy, dry, dry)

**Kinesthesia** - sensitivity to pressure and displacement of certain receptors in muscles and joints

**Loose consistency of a meat product** - a consistency of a meat product characterized by a relatively small mass per unit volume and loosely connected particles

**Laboratory method** - a method of determining the values of product quality indicators using special equipment, reagents, dishes and other auxiliary equipment

**Masking** - reduction of the intensity or disappearance of the sensation of a stimulus under the simultaneous influence of one or more stimuli

**Masking of smells** - cases of suppression of one smell by another. If two or three smells act on the olfactory organ at the same time, it may happen that none of them will show their true properties, and the sense of smell will be vague or not perceived at all

**Methods of determining product quality indicators** - methods used to determine the quantitative value of product quality indicators

**Microbiological methods** are used to determine the degree of contamination of food products by microorganisms and their type

**Measuring vessel –** vessel for measuring volumes of liquid samples

**Nanosensor** - a sensor in the manufacture of which nanomaterials and nanotechnology of microcircuits and nanoelectromechanical systems (NEMS) are used, with an electrical output signal

**Odor defect** - a shade of the smell of a food product that is not characteristic of a product of good quality

**Objectivity** - judgments by an expert that reflect the actual level of quality of the evaluated products. Non-objectivity consists in overestimating or underestimating the values characterizing the properties of objects for reasons unrelated to quality.

**Open tasting** takes place in light rooms specially designed for this purpose.

**Odorimetry** - measurement of the intensity and persistence of odor as properties of a compound

**Olfactometry** - measurement of the characteristics of a person's olfactory sensitivity

**Organoleptics** - a field of science that studies the properties of food products, their intermediate forms and ingredients that cause a human sensory response

**Organoleptic analysis** - sensory analysis of food products, taste and aromatic substances using sight, hearing, smell, taste, touch

**Organoleptic taster** - any person who participates in organoleptic analysis

**Product property** - an objective feature of the product that manifests itself in the sphere of commodity circulation, consumption or exploitation

**Product grade** - product grading based on one or more quality indicators established by regulatory documentation

**Property, indicator, attribute, parameter** – characteristics one can feel

**Preservation** - property of products to retain quantitative and qualitative indicators for a certain time, which ensure their use for their intended purpose after transportation and storage

**Product quality category** - product quality gradation established during state certification

**Production tasting** is carried out by a commission within the enterprise, association or management. It is conducted by a group of specialists of the enterprise, an association when solving issues related to the evaluation of food products (preparation for the approval of new types, approval of recipes, selection of samples for the competition, etc.). For this purpose, a production tasting commission is created at each enterprise, which unites the most qualified specialists.

**Paraheusia** - a distorted ability to feel a taste that is not characteristic of a given substance or group of substances

**Paragnosia** - a distorted ability to feel the taste that is not characteristic of a given substance or group of substances

**Parosmia** - a distorted ability to smell a smell that is not characteristic of a given substance or group of substances

**Panel tests** - tests carried out by a group of people for the organoleptic evaluation of the quality of a food product or to study the reaction of a person to the quality of a product

**Piezoelectric effect** - the effect of polarization of the dielectric under the action of mechanical stresses (direct piezoelectric effect). There is also a reverse piezoelectric effect - the occurrence of mechanical deformations under the action of an electric field

**Planar technology** - a set of technological operations used in the manufacture of planar (flat, surface) semiconductor devices and integrated microcircuits

**Plasticity** - a characteristic of the texture, which expresses the property of the food product to be stored without destruction in the process and after the termination of the deforming effect

**Product quality indicator** - a quantitative characteristic of one or more properties, which is considered in accordance with the defined conditions of its operation or consumption

**Preliminary taste** - the initial, short-lived taste of a food product, which precedes the main taste of the product, characteristic of it

**Psychological selection** - the admission of people to some specific type of activity based on an assessment of their abilities. Such abilities include: sensitivity of the analyzer, attention, memory, mental, linguistic motives of behavior, attitude towards oneself, towards other people, sociability

**Psychophysics** - a science that studies the relationship between stimuli and corresponding sensory reactions

**Perception** - the direct display of product properties in the mind, the ability to perceive, distinguish and assimilate information using the senses

**Product quality** is a set of product characteristics that determine the degree of ability to satisfy established and anticipated needs

**Physiological fatigue** - a decrease in the sensitivity of the senses under the influence of long sensory impulses caused by the evaluator's psychological fatigue

**Phonism** - the occurrence of auditory sensations under the action of non-specific stimuli (light stimuli can cause side auditory sensations)

**Photism** - the emergence of visual images under the influence of stimuli that do not correspond to them (the emergence of color sensations under the influence of music)

**Quality control** - an activity that includes conducting test measurements or evaluating product characteristics and comparing the obtained results with established requirements to determine whether compliance has been achieved for each of these characteristics

**Quality criterion** - a parameter chosen among others for the overall assessment of product quality

**Quality** is a set of properties and characteristics of a product, which gives it the ability to satisfy stipulated or anticipated needs

Q**uestionnaire -** list of specific questions, and sometimes, a list of options for possible answers

**Requirements for product quality** - the expression of certain needs by translating them into a set of quantitatively or qualitatively established norms regarding product characteristics to ensure the possibility of verification during intended use

**Reliability** - a quality characteristic of the product that determines the ability to keep within the established limits the values of all parameters regarding the ability to perform the required functions in the specified modes and conditions of use, maintenance, storage, and transportation

**Retronasal effect** - molecules of an odorous substance, entering the nasopharynx, and from there to the taste buds, cause taste sensations. At the same time as taste sensations, tactile and temperature sensations arise in the oral cavity, which can merge so much that they form a complex that cannot be analyzed and broken

down into elements

**Receptors** - highly sensitive cells that, during the evolution of the animal organism, have adapted to the perception of impulses from certain stimuli

**Receptor** - cells specialized for perceiving a certain type of irritation or the end of a neuron, capable of converting a material carrier of information into an electrical process - a nerve impulse

**Reproducibility** - ability to characterize the taster's ability to restore in memory the evaluation of products of similar quality after a certain period of time

**Shelf life** - after the expiration of this period, the food product is suitable for consumption, but its consumer characteristics may be reduced

**Sweet taste** - a sensation for which a typical taste stimulus is an aqueous solution of sucrose

**Sweetness** - the organoleptic property of individual substances or mixtures to cause a sweet taste

**Salty taste** - a sensation for which sodium chloride solution is a typical taste stimulus

**Saltiness** - the organoleptic property of individual substances or mixtures to cause a salty taste

**Smell memory** and perception is the ability of a person to recognize those smells that he had previously encountered, that is, to remember and recognize a known smell

**Smell** - aromatic molecules

**Sample** - an instance or part of a product presented for analysis

**Sight** - one of the most important human tools that communicates with the outside world

**Sight** - visual perception; establishment of differences in the surrounding world by the eye's perception of light rays of the visible part of the spectrum

**Sour taste** - a sensation for which a typical taste stimulus is a water solution of acetic or citric acid

**Sensation** - subjective reaction to the stimulation (excitation) of the senses

**Sensitization** - a permanent increase in sensitivity caused by the repeated action of weak stimuli, applied one after the other after certain intervals of time

**Sensitization** - an increase in sensory sensitivity to stimuli

**Sensors** are a special class of information machines designed to extract information from the surrounding natural and/or man-made environment

**Sensory ability** - the ability of the senses to perceive organoleptic indicators

**Sensory memory** - the ability to remember and recognize various impulses and sensory impressions

**Sensory analysis** - a quality assessment carried out by experts who have previously tested the organs of sense and sight, which guarantee the accuracy and reproduction of the results

**Sensory minimum** - the minimal sensitivity and ability of the senses to perceive impressions

**Synergism** - an increase in the intensity of a feeling as a result of the joint action of two or more stimuli, which exceeds what is expected from a simple increase in the effects of each individual stimulus

**Synesthesia** - (Gr. "simultaneous feeling, shared feeling") - a phenomenon of perception, when when one sense organ is irritated next to its specific sensations, sensations corresponding to another sense organ arise

**Secondary or residual taste** - the taste that appears after the product has been tested, persists for some time and differs from the characteristic taste

**Selected tester** - taster selected for his/her ability to perform the organoleptic test

**Selected taster** is a taster with proven sensitivity, recognized by the results of tests as capable of organoleptic evaluation of products.

**Safety of food products** - the absence of toxic, carcinogenic, mutagenic and other adverse effects of food products on the human body when using them in physiologically accepted amounts

**Sensory adaptation** - a temporary change in the sensitivity of a sense organ as a result of long-term and / or repeated exposure to a stimulus

**Specific odor persistence** - the time in hours, multiplied by 100, during which 1 g of a solution with a mass fraction of a substance of 1% retains its odor under standard conditions.

**Stickiness** - characteristic of the texture as a property of a food product, resulting from the effort required to overcome the force of gravity between the product's surface and the tongue, palate, teeth, or hands

**Saturation (purity)** of perceived color is described by concepts: weak, strong, pale, dull, saturated, etc. (when mixing chromatic and achromatic colors, the tone or shade is determined by the chromatic color, and the saturation by the achromatic color (gray tones do not have saturation, but differ in lightness)

**Saturation threshold** - the minimum value of the stimulus above which there is no noticeable difference in the intensity of the sensation caused by it

**Safety indicators** - characterize the harmlessness of product consumption for humans

**Sensitivity** - the ability of the senses to perceive, identify and/or differentiate qualitatively and/or quantitatively one or more stimuli

**Taste modifiers** - substances capable of changing the taste quality

**Taste defect** - an aftertaste in a food product that is not characteristic of a product of good quality

**Taster** - tester, selected tester or expert who evaluates the organoleptic indicators of a food product mainly with the help of oral cavity sensors

**Taster** - a person who is attracted to organoleptic quality tests of a product after checking his sense organs for pathology

**Taste** is a unit of taste sensation. One taste is equal to the sensation caused by a solution of 1 g of sugar in 100 cm3 of water. The strength of suppressing or expanding the taste in the mixture depends on the concentration and palatability of the dominant substance (or suppressing substances) and does not obey Stevens' rule. For example, weak acetic acid does not suppress the sweetness of sucrose, but weak lactic and citric acids suppress it.

**Tasting** is an organoleptic evaluation of a food product in the oral cavity

**Touch** - the ability to accept the effect of environmental factors with the help of receptors on the skin surface and the mucous membrane of the oral cavity

**Touch** - tactile perception; recognizing the characteristics of the shape and structure of the product through direct contact with the skin

**The properties of the functional purpose** - consumer properties of the product which underlie its intended use as an object of consumption, that is, they characterize: conformity of the product to its intended purpose; beneficial effect of consumption; the degree of satisfaction of a specific need by the product

**The hedonic method** - organoleptic method of assessing the pleasantness or unpleasantness of the properties of a food product

**The vulnerability of the taster** - ability to perceive impulses as information about food products, compare them with information stored in memory, and on this basis make an analysis of the properties of this product

**The relative value of the product quality indicator** - ratio of the value of the quality indicator of the evaluated products to the base value of the indicator

**The study of the quality of the product** - the study of the regularities of identifying the consumer properties of the product according to its purpose in certain conditions of circulation and consumption

**The type of meat product on the cut** - a property of the meat product that can be recognized with the help of the organ of vision

**The subject** - a person who takes part in tests, the purpose of which is to study human reactions to the product, and not to evaluate the quality of the product.

**The production tasting commission** evaluates the traditional and new products of enterprises

**The bitter taste of a meat product** is a component of the taste of a meat product, similar to the taste of water solutions of quinine and caffeine

**The limit value of the quality indicator** is the largest or smallest regulated value of the quality indicator

**The differential threshold** - minimum change in the amount of the identified stimulus that causes a change in the intensity of its sensation

**The smell of a meat product** - property of a meat product that can be recognized with the help of the sense of smell

**The residual taste of a meat product** - taste felt by the taster after finding the product in the mouth

**The smell of burning** is best expressed by substances such as roasted coffee

**The coefficient of significance** reflects the value given to individual indicators for assessing the overall quality. This makes it possible to differentiate the significance of individual quality factors

**The appearance of a meat product** - a property of a meat product that can be recognized with the help of the organ of sight

**The sour taste of a meat product** - a component of the taste of a meat product, similar to the taste of aqueous solutions of citric and tartaric acids

**The color of the meat product** - a property of the meat product that can be recognized with the help of the organ of sight

**The consistency of a meat product** - a property of a meat product that characterizes its stability during chewing and (or) deformation

**The "two out of five" method** - an organoleptic method of evaluating two product samples, represented by five coded samples, three of which are identical to one sample and two to the other, by dividing the same samples into two corresponding groups

**The "duo-trio" method** - an organoleptic method of evaluating two pairs of coded samples by comparing them with a marked standard sample.

**The method of determining visual sensitivity** - determined by the complex ability of the subjects to correctly distribute red, yellow, and green color solutions according to the increasing intensity of the color, and not by determining visual sensitivity in the generally accepted sense of this expression. The ability that the taster must possess is the absence of color blindness, the ability to recognize color gamuts of a certain strength and to recognize them by their intensity (this should be expressed in numerical values, in order to

have a concrete, objective picture of their level of development), this method is not reveals

**The method of determining olfactory sensitivity** - sensitivity is measured through thresholds. First, stidy the ability to associate smells with the smells of food products and the ability to determine the names of chemicals in test tubes. The second part is considered redundant, since it is known that chemicals with different names can smell the same. For a taster, knowledge of terms to denote sensations is necessary, for example: the smell of yeast, musty smell, fodder smell, etc.

**The method of determining taste sensitivity** is carried out in three stages: the ability to recognize the four main types of taste, the determination of the threshold for the recognition of taste substances, and the ability to determine the difference in taste is determined by the "duo-trio" or triangular method. There are no criteria for evaluating individual results at each stage and the overall success of the tests.

**The hedonic scale method** - an organoleptic method of assessing the degree of pleasantness or unpleasantness of the properties of a food product

**The dilution index method** - an organoleptic method in which the degree of dilution of the samples with water gives a quantitative assessment of the change in the intensity of taste or smell, and the samples are offered in the order of their sequential dilution

**The method of limits** - an organoleptic method of determining stimulus threshold values by averaging the values obtained during the evaluation of two series of samples containing the stimulus in increasing and decreasing concentrations

**The method of single stimuli** - an organoleptic evaluation method, in which the tester, after getting acquainted with the standard (A) and different (not A) product samples, identifies them in a series of coded samples.

**The pairwise comparison method** - a method of ranking two coded samples

**The ranking method** - an organoleptic method of evaluating coded samples by placing them in a row in order of change in intensity or degree of expression of a given product characteristic

**The method of multiple standards** - an organoleptic method of selecting a sample from a given series that is significantly different from standard samples representing the product in several types (from two to five).

**The scaling method** - an organoleptic method of quantitative assessment of the intensity of separately selected descriptive characteristics (descriptors) of the properties of a food product or their combination (using different scales).

**The extraneous taste of a meat product** - a taste that is not characteristic of a meat product of this type;

**The salty taste of a meat product** - a component of the taste of a meat product, similar to the taste of an aqueous solution of table salt

**The juiciness of a meat product** - the property of a meat product with a tender consistency, containing a relatively large amount of moisture, which is in a bound state

**The preparatory expert stage of the examination** - the purpose of the work is formed, the methods and procedures of the work are selected, the expert group (tasting commission) is formed, the questionnaire for the survey of experts (tasting sheets) is developed.

**The quality of a food product** - a set of characteristics of a food product that determine the degree of ability to ensure the stability of the composition and useful properties of the product during the shelf life

**The brightness (lightness) of the perceived color** is characterized by the following terms: dark, light, bright (density, which does not change the shade); depends on the background against which the

object is viewed and the brightness of the lighting

**Tenderness** - a conventional term, assessed as the resistance that a product makes during chewing (for example, a soft apple, a crispy cucumber, tender meat)

**Tender consistency of the meat product** - the consistency of the meat product, which is characterized by a slight resistance to chewing and (or) deformation

**The nominal value of the quality indicator** - the regulated value of the quality indicator, from which the permissible deviation is calculated

**The volume of the taster's taste vocabulary** is the number of specific words that the taster knows and uses when describing the taste of the evaluated product before the selection.

**The organoleptic method** is a method of determining the values of product quality indicators based on the analysis of the perception of human senses

**The optimal value of the quality indicator** - the value of the quality indicator at which the greatest effect from consumption is achieved

**The level of product quality** - a relative characteristic of quality, based on a comparison of the set of quality indicators of the evaluated products with the corresponding set of basic indicators

**The level of product quality** - a relative characteristic based on a comparison of the value of the quality indicators of the evaluated products with the basic values of the corresponding indicators

**The work of the expert group** is to determine the nomenclature of indicators, their weighting coefficients, terminology; selection of the basic values of the investigated features, performance of evaluations of single and complex quality indicators; determination of the assignment of the limits of quality categories

**The extraneous smell of a meat product** - a smell that is not characteristic of a meat product of this type

**The taste of a meat product** - a property of a meat product that can be recognized with the help of the organ of taste

**The porosity of the meat product** is a property of the meat product that characterizes the presence of small voids on its cross section

**The threshold of detection** is the minimum value of the stimulus necessary for the sensation to occur. The stimulus can be identified

**The recognition threshold** is the minimum value of the stimulus that allows qualitatively describing the nature of the sensation.

**Transparency** - a property of liquid products, which is determined by the degree of light transmission through a liquid layer of a certain thickness

**The profile method** - an organoleptic method of qualitative and quantitative assessment of a set of signs - properties: aroma, taste, texture using pre-selected descriptive characteristics - descriptors

**Taste -** a sensation that occurs when receptors are excited and is determined both qualitatively (sweet, salty, sour, bitter) and quantitatively (taste intensity)

**The elastic consistency of the meat product** is the consistency of the meat product, which is characterized by the restoration of the original shape after the cessation of mechanical impact

**Taste, pleasantness** - a set of features of a product that make it desirable for consumption. The term "sweetness" cannot be used as a synonym for the term "flavor"

**The method of giving preference** is that the expert taster must place all quality indicators in the order of giving preference

**Texture** - the term refers to the macrostructure of a food product, which is characterized by a complex of visual, auditory and tactile

sensations that occur during chewing the product

**The term of sale** is set for food products, taking into account some reasonable period of storage of products at home

**Thermometers** - tools for measuring temperature

**Thermostat** - tool for thermostating samples at a given temperature

**Triangular method** - the organoleptic method of selection, deals with three coded samples, two of which are identical

**The characteristic smell of a meat product** - the smell related to a given type of meat product

**The characteristic taste of a meat product** is the taste related to a given type of meat product

**The Central Tasting Commission** - selectively controls the quality of beverages of individual enterprises. It evaluates and approves new types of products, checks and gives a conclusion on the quality of products intended for export, for exhibitions and competitions

**The central part** is the sphere of the cerebral cortex, which consists of a group of nerve cells that perceive nerve impulses, which, as a result of the most subtle analysis, turn into sensations

**Viscous consistency of a meat product** - the consistency of a meat product characterized by relatively low resistance to deformation, which allows it to be spread on another product and provide adhesion to it

**Working tasting** is conducted directly in the production premises by technologists, chemists, heads of laboratories and heads of technical control departments. They assess the quality of raw materials, semi-finished products and finished products

# APPLICATIONS

## Appendix 1. Questionnaires for evaluating the quality of food products by comparison methods

### 1. Questionnaire for a simple assessment of two samples

Name _____ Date _____

Appreciate the juiciness of these two canned crab samples. Try the sample on the left first. Indicate which one is juicier.

581 716

Remark:

### 2. Questionnaire for pairwise comparisons with an indication of the magnitude of the observed difference

Name _____ Date _____

Check out these two fried fish samples for juiciness.

1. Indicate the degree of difference in the juiciness of the two samples based on checking one of the following factors:

**Table 1.1. The degree of difference in juiciness**

| | | |
|---|---|---|
| 846 | much juicier than | 165 |
| 846 | juicier than | 165 |
| 846 | slightly juicier than | 165 |
| | there is no difference | |
| 165 | slightly juicier than | 846 |
| 165 | juicier than | 846 |
| 165 | much juicier than | 846 |

2. Rate the juiciness of each sample:

**Table 1.2. Savor the samples**

| 846 | 165 |
|---|---|
| –very dry | –very dry |
| –moderately dry | –moderately dry |
| –slightly dry | –slightly dry |
| –slightly dry | –slightly dry |
| –moderately juicy | –moderately juicy |
| –very juicy | –very juicy |

Remark:

### 3. Questionnaire for evaluation by the triangle method

Name _____ Date _____

Two of these three samples are identical, the third is different from them.

1. Try the samples in the order shown and identify the odd sample:

**Table 1.3. Identification of odd samples**

| Code | Check the odd sample |
|---|---|
| | |
| | |
| | |

2. Specify the degree of difference between the samples.

| | |
|---|---|
| Weak | |
| Moderate | |
| Big | |
| Extreme | |

3. Eligibility:

- An odd pattern is more acceptable _____
- Paired samples are more acceptable _____

Remark:

### 4. Questionnaire for evaluation by the two-pair method when comparing two samples

Name _____ Date _____

On the plate in front of you is a control sample marked with the letter "K" and two coded samples. Which of the coded patterns is different from "K"?

Sample Check the odd sample

432 _____

721 _____

Remark:

## 5. Questionnaire for evaluation by the two-pair method when comparing several samples

Name _____ Date _____

You receive samples of fish to compare their density. You are presented with a control sample marked with the letter "K" to which you must compare each sample. Try each sample, determine if it is denser or softer compared to the control. Then note the degree of difference that exists.

**Table 1.4. Evaluation by the two-pair method when comparing several samples**

| **Sample number** | 426 | 591 | 497 | 874 |
|---|---|---|---|---|
| Dense | | | | |
| Same | | | | |
| Softer | | | | |
| Degree of difference: | | | | |
| No difference | | | | |
| A little different | | | | |
| Moderately different | | | | |
| Quite different | | | | |
| Extremely different | | | | |

When determining the degree of difference, use the grades: 5 - "no difference", 9 - "extremely different in density from "K"", 1 - "extremely different in softness from "K"".

## 6. Questionnaire for evaluation by the method of simple placement

Name _____ Date _____

Classify these samples by sweetness. First select the sweetest sample, followed by the second and third; the sample that is least sweet will be fourth.

Write the sample numbers in the appropriate cells. Taste the samples in the following order: 212 336 471 469

**Table 1.5. Recording samples after tasting**

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | 4 |

Remark:

### 7. Questionnaire for assessment by the placement method using an interval scale

Name _____ Date _____

Please rate the density and chewiness of these fish sausage samples.

1. In order to indicate your estimate of the density of each sample, first you need to draw vertical lines on the horizontal one. Sign each vertical line with the number of the sample.

Try the samples in the following order: 572 681 437 249

Very soft Very dense

2. In order to indicate your assessment of the chewing ability of each sample, first you need to draw vertical lines on the horizontal one. Sign each vertical line with the number of the sample.

Too difficult to chew Very easy to chew

### 8. Questionnaire for consumer assessment of the quality of fish products and canned goods

A. For fish products

Name _____ Date _____

Surname and first name of the taster _____

When answering the question below, choose the answer you prefer and circle it. Before trying the fish, read the questions carefully and make sure that you have no doubts about their content. If you are not sure of the correct understanding of a particular question, get an explanation from the responsible person.

Answer while chewing fish without changing the sequence of questions.

**Table 1.6. Table of consumer assessment of the quality of fish products**

| 1. There is fish: | Points: |
|---|---|
| Dry | 1 |
| A little dry | 2 |
| Ordinary | 3 |
| Juicy | 4 |
| Very juicy | 5 |
| 2. Fish is: | Points: |
| Hard, solid | 1 |
| Ordinary | 2 |
| Moderately gentle | 3 |
| Gentle | 4 |
| Very gentle | 5 |

Answer the same questions after the tasting.

3. Rate the overall acceptability of the product on a five-scoring scale in words:_____

B. For canned fish

Name _____ Date _____

Surname and first name of the taster _____

Answer the following questions and give a score in the indicated places. In cases where the questions are repeated, it is necessary to answer them. You must give a positive answer to one of these questions, and a negative answer to the others. Circle the positive answer.

Before the tasting, make sure you understand the questions and answers correctly. If in doubt, contact the person in charge.

Do not argue during the tasting and do not comment on your opinion.

Answer without trying.

1. Do you think that canned goods, from the point of view of their quality in appearance: absolutely unacceptable - 1 point, not bad - 2 points; almost good - 3 points; good - 4 points; very good - 5

points.

2. If the score you give when answering the previous question is between 1 and 3, mark what you see as defects:

- In fish
- In butter or sauce,
- Throughout the product.

3. Describe the defect that caught your attention.

4. Is the smell of the food normal? (yes/no). If not, is it similar to any of the following smells:

- Burnt,
- Unpleasant,
- Indeterminate,
- Boiled meat,
- Sulfur,
- Ammonia,
- Rotten

If its smell is not similar to any of the above, mark with which smell you would compare it:_____

5. Fish color:

Very pale - 1 point; pale - 3 points; ordinary - 5 points; dark - 3 points; very dark - 1 point.

6. Amount of sauce or butter:

- Very little - 1 point;
- Little - 3 points;
- The usual amount is 5 points;
- Many - 3 points;
- A lot - 1 point.

7. Content of tomatoes in the sauce:

- Very little - 1 point;
- Little - 3 points;
- The usual amount is 5 points;
- Many - 3 points;

- A lot - 1 point.

8. Butter content in the sauce:

- Very little - 1 point;
- Little - 3 points;
- The usual amount is 5 points;
- Many - 3 points;
- A lot - 1 point.

Answer the questions during the tasting, while trying only the fish.

9. Fish density:

- Very dense - 1 point;
- Dense - 3 points;
- Normal – 5 points;
- Soft - 3 points;
- Very soft - 1 point.

10. Fish juiciness:

- Very dry - 1 point;
- Dry - 2 points;
- Moderately juicy - 3 points;
- Juicy - 4 points;
- Very juicy - 5 points.

11. Try the fish and the sauce or butter at the same time and evaluate the taste. If it is ordinary, then rate it on a five-scoring scale depending on how much you liked it:_____

If the taste is unusual, what is it:

- Bitter
- Sour
- Sweet
- Salty

12. Scent. If the smell is ordinary, then rate it on a five-scoring scale depending on how much you liked it:_____

If the smell is unusual, check your answer in paragraph 4 again.

13. Spices:

- A lot - 1 point
- Many - 3 points
- The usual amount - 5 points
- Not enough - 3 points
- Very little - 1 point

If the spices are not balanced, then write which seasoning is more or less: _____

14. The overall impression you felt during the tasting was:

- Unpleasant - 1 point;
- Normal - 3 points;
- Pleasant - 5 points.

15. After finishing the tasting, give an overall rating of the acceptability of the product on a five-scoring scale: _____

16. After you tried this type of canned food, would you like to try it again? (yes/no).

Answer question 17 10 minutes after the tasting. During this period of time, you should not eat, drink or smoke.

17. The taste that remains after tasting:

- Unpleasant
- Usual
- Pleasant

## Appendix 2. Examples of a scoring scale for assessing sensory properties of fish products

Examples of the scoring scale for assessing the sensory properties of fish products (tables 2.1-2.10).

**Table 2.1. Scoring scale and verbal description of organoleptic indicators of canned fish in tomato sauce**

| Indexes | Points | Characteristic |
|---|---|---|
| 1 | 2 | 3 |
| The number of pieces of fish and their stacking | 5 | The number of pieces of large specimens of fish in a jar with a capacity of up to 353 ml is slightly more than three, except for one makeweight. No more than half of the tail pieces in canned fish cut in half, and no more than one-third of the total number of pieces in canned small fish cut into transverse pieces along the height of the can.<br>A cutlets - no more than four, the number of meatballs, and knelles is not regulated. The pieces of fish were carefully laid crosswise to the bottom of the can. The height of the fish pieces corresponds to the inner height of the can. Pieces of small fish are laid flat in parallel or mutually crossing rows, sardine carcasses - with the belly facing up, the main part towards the tail. Fish carcasses are equal in length. Allowed:<br>- Laying the kilka and smelts with thoroughness leveling;<br>- Placing small fish carcasses in glass jars vertically, pieces of fish - in two rows - stacking cutlets - on a rib or flat.<br>When stacking by machine, the number of tail pieces of herring, mackerel, horse mackerel and cod is not standardized. |

**Continuation of table 2.1**

| 1 | 2 | 3 |
|---|---|---|
| The number of pieces of fish and their arrangement | 4 | The number of tail pieces of large specimens of fish is no more than one. Pieces of fish are neatly laid crosswise to the bottom of the can. Slight deviations from correct stacking are allowed (stacking of one piece of flatfish, packaging of individual pieces of fish in two rows during machine stacking) |
| The number of pieces of fish and their arrangement | 3 | Stacking pieces of fish and whole carcasses of small fish is not correct. The length of the carcasses of small fish is not the same |
| Fish condition | 5 | Very pleasant. Pieces, carcasses and fillets of whole fish,<br>have equal sections. The integrity of small fish (hulls, gills) is not regulated. The products are identical in shape and size. When carefully laying out pieces of fish fillets from the can, they do not fall apart. Breading is uniform |
| Fish condition | 4 | Pleasant. Pieces of carcasses and fish fillets are whole, have equal cuts. When carefully laying out from the can, individual pieces, carcasses, fillets may fall apart, minced meat may break. Breading is uneven, absent on individual pieces or carcasses |
| Fish condition | 3 | Less pleasant. Pieces, carcasses and fillets of fish are whole.<br>Most of the pieces fall apart when you carefully remove them from the jar. Too much or not enough breading |
| Fish condition | 2 | Unpleasant. Pieces, carcasses and fillets of fish are shapeless, molded |
| Taste and smell | 5 | Pleasant, pronounced, characteristic of fried or boiled fish, minced meat,<br>tomato sauce (with or without the addition of red pepper puree) and the aroma of spices |

**Continuation of table 2.1**

| 1 | 2 | 3 |
|---|---|---|
| Taste and smell | 4 | Pleasant, less pronounced, characteristic of preserves in tomato sauce (with or without the addition of red puree) pepper) and the aroma of spices |
| Taste and smell | 3 | specific, unexpressed, weakened, with a predominance of one of the components |
| Taste and smell | 2 | weakly expressed, with a predominance of the smell of fried onions or overcooked tomato sauce |
| Taste and smell | 1 | Inexpressive, unpleasant with excessive predominance of one of the components, with a taste of oxidized fat |
| State of tomato sauce | 5 | Uniform, enveloping pieces of fish |
| State of tomato sauce | 4 | Uniform with small lumps of flour, enveloping pieces of fish |
| State of tomato sauce | 3 | Heterogeneous with a slight moisture deposit |
| State of tomato sauce | 2 | Heterogeneous with a separated water part |
| State of tomato sauce | 1 | Watery, low density |
| The color of tomato sauce | 5 | From bright orange to red |
| The color of tomato sauce | 4 | From light orange to reddish brown |
| The color of tomato sauce | 3 | With a predominance of brown shades |
| The color of tomato sauce | 2 | Brown |
| The color of tomato sauce | 1 | Dark brown |
| Consistency of meat, fish, minced meat | 5 | Juicy, tender, dense |
| Consistency of | 4 | Not dense enough, dry, slightly boiled |

**Continuation of Table 2.1**

| 1 | 2 | 3 |
|---|---|---|
| meat, fish, minced meat | | |
| Consistency of meat, fish, minced meat | 3 | Dry, overcooked, boiled |
| Consistency of meat, fish, minced meat | 2 | Fibrous, very boiled |
| Consistency of meat, fish, minced meat | 1 | Hard, too soft, looks like porridge |
| Bone condition | 5 | Soft, easily chewed or crushed |
| Bone condition | 4 | Soft, chewable or crushed with little effort |
| Bone condition | 3 | Hard, difficult to chew and crush |
| Bone condition | 2 | Hard, chewed or crushed with considerable effort |
| Bone condition | 1 | Dense, not chewy |

**Table 2.2. Score scale for evaluating the organoleptic parameters of hot smoked fish**

| Evaluation of indicators, points | Appearance, color | Taste | Aroma | Consistence | Succulence | Overall assessment |
|---|---|---|---|---|---|---|
| Positive indicators | | | | | | |
| 7 | Excellent, uniform, brown | Very tasty | Very nice strong | Very gentle | Very juicy | Excellent |
| 6 | Very good, golden brown | Delicious | Pleasant not strong | Gentle | Juicy | Very good |
| 5 | Good, uneven | Quite tasty | Pleasant weak | Gentle enough | Juicy enough | Good |
| 4 | Good enough | Not tasty enough | Insufficiently expressed | Not tender enough | Not juicy enough | Above average |
| Negative indicators | | | | | | |
| 3 | Average, uneven, pale | Not tasty | Without fragrance | Not gentle | Not juicy | Average |
| 2 | Unpleasant | With an unpleasant aftertaste | Unpleasant | Dense | Dry | Below average |
| 1 | Very unpleasant | With an unpleasant taste | Bad | Hard | Dry, crumbles | Bad |

**Table 2.3. 10-scoring scale for evaluating food products**

| Evaluation, points | Appearance | Color on the cut | Smell, taste | Consistence | Overall assessment | Note |
|---|---|---|---|---|---|---|
| 10 | Extra | Extra | Extra | Extra | Extra | |
| 8 | Very good | Very good | Very good | Very good | Very good | |
| 6 | Good (normal) | Good (normal) | Good (normal) | Good (normal) | Good (normal) | |
| 4 | Average | Average | Average | Average | Average | |
| 2 | Bad | Bad | Bad | Bad | Bad | |

**Table 2.4. Organoleptic assessment of the quality of fish products (highest score in points)**

| Indexes | Fish | | | | | | |
|---|---|---|---|---|---|---|---|
| | frozen | salty | smoked | dry and dry-cured | balik products, dry-cured and cold-smoked | caviar | preserves |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1. Processing and stacking of fish, minced meat, vegetables and side dishes | | | | | | | |
| 2. Color | | | | | | | |
| 3. Condition of fish, pieces or products made from minced fish and fish skin | | | | | | | |
| 4. The number | | | | | | | |

**Continuation of table 2.4**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| of pieces, carcasses, products made of minced meat or meatballs and their color | | | | | | | |
| 5. Meat consistency (for frozen fish after thawing) | | | | | | | |
| 6. Taste and smell (for frozen fish after thawing and cooking) | | | | | | | |
| 7. Appearance | | | | | | | |
| *Total* | | | | | | | |
| 8. Artistic design of consumer packaging | | | | | | | |

**Table 2.5. The scale of organoleptic evaluation of the quality of canned fish with the indication of the maximum values of each single indicator**

| Indexes | Sprats | Sardines | Fish | | | | Natural squid | Natural msde of fish | Natural made of liver | Fish broth and soups | Fish and plants | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | In oil | Smoked in oil | In tomato | Natural made of | | | | | In tomato sauce | In oil |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 1. Disassembly and assembly of fish, minced meat, vegetables and side dishes | | | | | | | | | | | | |
| 2. Color | | | | | | | | | | | | |
| 3. Condition of fish, pieces or products made from minced fish and fish skin | | | | | | | | | | | | |
| 4. The number of pieces, carcasses, products made of minced meat or meatballs and their color | | | | | | | | | | | | |

**Continuation of table 2.5**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| 5. The color of the broth, tomato sauce, fat and the transparency of the oil | | | | | | | | | | | | |
| 6. The consistency of meat | | | | | | | | | | | | |
| 7. The ratio of product and oil | | | | | | | | | | | | |
| 8. Taste and smell | | | | | | | | | | | | |
| 9. Appearance | | | | | | | | | | | | |
| 10. Color of meat and broth | | | | | | | | | | | | |
| 11. Artistic design of consumer packaging | | | | | | | | | | | | |

**Table 2.6. Scoring of fish in tomato**

| Indexes | Rating | | |
|---|---|---|---|
| | The lowest acceptable | Standard | Higher |
| 1. Net weight and ratio between fish and dressing | 15 | 20 | 20 |
| 2. The appearance of the can | 7 | 10 | 13 |
| 3. Color, taste, smell | 25 | 35 | 45 |
| 4. Dense leftover of canned goods | 14 | 20 | 25 |
| 5. Absence of defects | 10 | 15 | 20 |
| *Total* | 71 | 100 | 123 |

Note. Higher grade - more than 100 points; 1st grade - 95-100 points; below the standard - 85-94 points.

**Table 2.7. Standard table of 100-point evaluation of canned fish**

| Indexes | Defects | Downgrade, points |
|---|---|---|
| Can surface: | | |
| External | Dints on the body of the can | 1-3 |
| | Rust points more than 10 per 100 cm2 of can surface | 1-5 |
| | Spots of rust and corrosion | 2-10 |
| | Defects of the fold and cover, notches, dints, extrusion of sealing rubber rings with a fold | 1-5 |
| Internal | Strong yellowing of the tin coating | 1-5 |
| | Fair tin plating corrosion | 1-5 |
| | Partial curing of varnish | 1-5 |
| Filling | Voids in the jar: the fish is not sufficiently covered with the filling or the net weight deviates from the established one | 1-5 |
| The taste and smell of canned goods | Weakly expressed, lack of seasoning | 1-5 |
| | Weak metallic aftertaste | 3-10 |
| | Weak bitter taste of burnt tomato sauce | 3-10 |
| | Other deviations of taste, smell, which make canned goods unfit for consumption | 2-10 |
| | For every 0.2% of table salt, more than 2% | 1 |
| Laying and size of pieces | More than 30% of the pieces are not stacked correctly | 1-5 |
| | More than 30% of fish pieces with a length deviation of more than 2 cm | 1-5 |
| The consistency of fish | Undercooked fish, its individual pieces fall apart when carefully removed from the can | 1-2 |
| | Significant boiling and softening of the fish, more than 30% of the pieces fall apart when carefully removed from the can | 5-15 |
| | Fish is overcooked or overdried | 2-10 |

## Table 2.8. Scale of 75-point comprehensive assessment of the quality of salted barrel Pacific herring

| Quality indicator | Coefficient importance | 1 grade | | 2 grade | | non-standard |
|---|---|---|---|---|---|---|
| | | 5 points | 4 points | 3 points | 2 points | 1 point |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| *Sensory rating scale* | | | | | | |
| Appearance | 3 | The surface is clean, shiny in color characteristic of this species, without yellowing. Muscles of uniform gray color | The surface is quite clean, dull blue. A yellow coating on the surface of the herring (in places of consumption) is allowed. Muscles on the cross-section are gray with different shades | The surface is slightly tarnished. Surface yellowing is allowed. The muscles are dark gray with redness at the spine | The surface is tarnished. Surface yellowing that does not penetrate the meat is allowed. The muscles are dark gray in section, red at the spine | The surface is dirty gray, significant yellowing of subcutaneous lipids, with cells that have penetrated into the muscles. The meat on the cut at the spine is dark-red |
| External damage | 1 | The herring is intact, there are no damages | Broken gill covers, cracks, small breaks in the skin, traces of unification (clamps), a slightly ruptured abdomen, without significant exposure of guts is allowed. | Significant damage to fins, gill covers, skin breaks, a burst abdomen with significant exposure of the entrails are allowed. | Mechanical damage to the head, minor injuries, a burst abdomen with significant exposure of the insides, but without their falling out are allowed. | "Tearing" is allowed without restrictions, a bursting belly, with falling out of the entrails |

**Continuation of table 2.8**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Consistence | 2 | The fabrics on the back are elastic, the abdomen and insides are dense. The meat is juicy and tender. Muscles are quite difficult to separate from bones | Fabrics on the back are quite elastic. The abdomen and entrails are quite dense. The meat is less tender, juicy. The muscles are still tightly attached to the bones | Fabrics on the back are soft (or excessively dense). Abdominal muscles are softened. The meat is coarse (or excessively juicy). The muscles are easily separated from the rib bones | Fabrics on the back are soft (or excessively hard). Abdominal muscles are greatly softened. The meat is dry or watered. Muscles are easily separated from the entire skeleton | Fabrics on the back are flabby (or hardened). Abdominal muscles fall apart. The meat is hard (but watery), the muscles involuntarily separate from the rib bones in places. |
| Taste and smell | 4 | The taste and smell of well-ripened salted herring with the feeling of a delicate harmonic | The taste and smell are normal, herring-like without bad signs | Taste and smell with a weak sense of signs of lipid oxidation | The taste and smell of oxidized lipids are allowed. There may be a sour smell in the gills | The taste and smell of the bitterness of oxidized lipids. A sour smell in the gills is allowed |

**Continuation of table 2.8**

| *Scale of instrumental assessment* | | | | | | |
|---|---|---|---|---|---|---|
| Color number mg, $O_2$, in, % | 1 | 43-59 | No more than 68 | No more than 80 | No more than 91 | No more than 91 |
| 10 | 1 | 5-9 | 16 | 23 | 30 | 30 |
| 7,5 | 1 | 4-6 | 9 | 12 | 17 | 17 |
| 5 | 1 | 2,5-3,5 | 6,4 | 9,6 | 10,7 | 10,7 |
| Relative amount of damaged fish, % | 1 | 0-6 | 11 | 18 | 27 | 27 |
| Damage area (cm2) on average for 1 specimen | 1 | 0-0,7 | 1,9 | 4,1 | 7,3 | 7,3 |

**Table 2.9. Varieties of canned fish**

| Sort | Overall score, points | The maximum permissible reduction of the grade (points) for deficiencies | |
|---|---|---|---|
| | | in the taste and smell of canned goods | in the state of fish and filling |
| 1 | 100-90 | 2 | 3 |
| 2 | 89-80 | 5 | 6 |
| 3 | 79-70 | 8 | 10 |

**Table 2.10. Distribution of points on a 75-scoring scale depending on the quality of salted herring**

| Indexes | Gradation according to GOST 815-55 | | | | | |
|---|---|---|---|---|---|---|
| | 1 grade | | 2 grade | | 3 grade | |
| | Gradation on a 75-point rating scale | | | | | |
| | A high quality | 1 grade | 1-2 grade | 2 grade | 2nd grade, non-standard | Non-standard |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 50-scoring scale of sensory definitions | | | | | | |
| Appearance | 15 | 15 | 12 | 9 | 6 | 3 |
| External damage, no less | 4 | 4 | 4 | 3 | 2 | 2 |
| Consistency, no less | 8 | 8 | 8 | 6 | 4 | 1 |
| The taste and smell are no less | 20 | 16 | 16 | 12 | 8 | 4 |
| General indicator | 50-47 | 46-43 | 42-40 | 39-30 | 29-20 | Less than 20 |
| 25-scoring scale of instrumental definitions | | | | | | |
| Color number of lipids or their chloroform solutions, no less | 5+ | 5++ | 4 | 3 | 2 | 1 |
| The relative number of damaged fish in the lot, no less | 5+ | 5++ | 4 | 3 | 2 | 1 |
| The area of external damage on average for 1 copy, no less than | 5+ | 5++ | 4 | 3 | 2 | 1 |

**Continuation of table 2.10**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Acid number of lipids, no less than | 5+ | 5++ | 4 | 3 | 2 | 1 |
| Nitrogen of volatile bases, no less than | 5+ | 5++ | 4 | 3 | 2 | 1 |
| Minimum score | 5+ | 5++ | 4 | 3 | 2 | 1 |

Note. The "+" sign indicates the limit values of the best quality; "++" sign - limit values of worse quality.

## APPENDIX 3. Basic requirements for the compilation and application of scoring scales

**Compilation of scoring scales**. With the organoleptic method, dimensionless scoring scales are usually used to assess the quality of products.

The number of points on the scale is determined by research tasks, accuracy and reliability of the results, and the number of quality levels distinguished by tasters.

Scales with reliable visibility of each quality level are recommended for evaluating the organoleptic indicators of raw fish, fish products and canned goods; work with them should be available to tasters not only with high, but also with medium sensory sensitivity.

When evaluating products of the same type, it is necessary to use scales of the same type. Scoring scales are compiled for each type of raw fish, fish products and canned food, verbally characterizing individual quality indicators.

The main operations of compiling scoring scales and the sequence of their execution are as follows:

- establishment of the nomenclature of individual quality indicators;
- establishing quality gradations and assigning them points;
- design of the scoring scale

Establishment of the nomenclature of individual quality indicators. The nomenclature of individual organoleptic indicators should consist of indicators that affect product quality, which cannot break down into simpler ones.

Organoleptic indicators of the quality of raw fish, fish products and canned food are recommended for evaluation both by complex and individual indicators.

Establishing quality gradations and assigning them points. For each single indicator, a gradation is set that corresponds to the number of points on the selected scale.

The values of the maximum and minimum quality levels of single indicators are set depending on the goals of the organoleptic assessment. Each gradation is assigned a corresponding score depending on the presence of defects and their degree of expressiveness.

For the clear visibility of each point, a description of the characteristic features of the gradations is provided using the most accurate terminology.

Designing a scoring scale. The scoring scale is drawn up in the form of a table, in which columns 1 and 2 contain a list of established complex and single quality indicators, and columns 3 and 4 — their verbal description and the points they give.

Gradations of quality are listed in order of increasing number of defects and degree of their expressiveness.

Individual indicators in the scoring scales are listed according to the sequence of product review.

As an example, we will give a scoring scale for determining the quality level of canned goods "Far Eastern mackerel in tomato sauce" (Table 3.1).

**Table 3.1. Scoring scale**

| Comprehensive indicators | Unit indicators | Verbal description of scores | Scores |
|---|---|---|---|
| Appearance | Exposure of the vertebral bone | Missing in all pieces | 5 |
| | | The vertebral bone protrudes a quarter vertebra in no more than 30% of pieces | 4 |
| | | The vertebral bone protrudes a quarter vertebra in most pieces | 3 |
| | | The vertebral bone protrudes into the vertebral floor in no more than 30% of the pieces | 2 |
| | | The vertebral bone protrudes halfway up the vertebra in most pieces | 1 |
| | The size of the pieces | All pieces of fish are the same height | 5 |
| | | All pieces of fish are the same height | 4 |
| | | No more than 50% of pieces have deviations by height | 3 |
| | | No more than 75% of pieces have deviations by height | 2 |
| | | All the pieces in the jar differ in height | 1 |
| | Stacking | Correct, tight | 5 |
| | | Correct, but not tight | 4 |
| | | Sligt deviations from the correct one (one or two pieces are placed with thir backs inside the can) | 3 |
| | | Significant deviations (one or two pieces are placed flat) | 2 |
| | | Strong deviations (all pieces are placed incorrectly) | 1 |
| | The integrity of the pieces | All pieces are intact | 5 |
| | | No more than 25% of the pieces fall apart along the length of vertebral bone | 4 |

**Continuation of table 3.1**

| Comprehensive indicators | Unit indicators | Verbal description of points | Points |
|---|---|---|---|
| | | No more than 50% of the pieces fall apart along the length of vertebral bone | 3 |
| | | No more than 75% of the pieces fall apart along the length of vertebral bone | 2 |
| | | All the pieces fall apart | 1 |
| Appearance | Skin integrity | Objectives | 5 |
| | | Complex covers are slightly damaged (one or two pieces have slightly slipped skin) | 4 |
| | | Complex covers are slightly broken, the skin has slightly slipped in all pieces) | 3 |
| | | Complex covers are significantly damaged (two pieces are almost completely missing the skin) | 2 |
| | | Complex covers are strongly damaged (all pieces have almost no skin) | 1 |
| | Dismantling | Correct | 5 |
| | | No more than 25% pieces with an oblique cut are allowed | 4 |
| | | No more than 25% of pieces with an oblique cut and incomplete removal of the dorsal fin are allowed | 3 |
| | | No more than half of the pieces have an oblique cut and fins not completely removed | 2 |
| | | Most pieces have defects: oblique section, fins not completely removed | 1 |
| | The color of the flesh on the fracture | Light creamy | 5 |
| | | Creamy | 4 |
| | | Creamy with a yellow-hot shade | 3 |

**Continuation of Table 3.1**

| Comprehensive indicators | Unit indicators | Verbal description of scores | Scores |
|---|---|---|---|
| | | Creamy with a brown tint | 2 |
| | | Light brown | 1 |
| | The color of tomato sauce | Red-orange | 5 |
| | | Orange | 4 |
| | | Red, dark red, orange with a brown tint | 3 |
| | | Brown | 2 |
| | | Dark brown discolored | 1 |
| Appearance | Uniformity of tomato sauce | Homogeneous | 5 |
| | | A small amount of flour without separating the liquid part is allowed. | 4 |
| | | The presence of small pieces of meat and skin are allowed | 3 |
| | | Heterogeneous, separation of liquid part is allowed | 2 |
| | | Heterogeneous, exfoliating | 1 |
| Scent | The degree of odor properties | The smell is related to the given type of canned goods: | |
| | | Significantly expressed | 5 |
| | | Moderately expressed | 4 |
| | | A little expressed | 3 |
| | | Barely perceptible or sharp | 2 |
| | | Missing | 1 |
| | The degree of manifestation of the smell of additives | The bouquet is expressed | 5 |
| | | The bouquet is moderately expressed | 4 |
| | | Excessive smell of spices | 3 |
| | | Excessive smell of acid | 2 |
| | | A sharp smell of acid | 1 |

**Continuation of Table 3.1**

| Comprehensive indicators | Unit indicators | Verbal description of scores | Scores |
|---|---|---|---|
| Taste | Degree of taste property | The taste is related to the given type of canned food: | |
| | | Well expressed | 5 |
| | | Moderately expressed | 4 |
| | | Minor | 3 |
| | | Barely perceptible | 2 |
| | | Missing | 1 |
| | The degree of manifestation of the taste of additives | The bouquet is expressed | 5 |
| | | The bouquet is moderately expressed | 4 |
| | | Extra aftertaste of spices | 3 |
| | | Excess aftertaste of acid | 2 |
| | | A sharp taste of acid | 1 |
| The consistency of the solid part | Density | Dense | 5 |
| | | Compacted | 4 |
| | | Slightly soft | 3 |
| | | Soft | 2 |
| | | Very soft | 1 |
| | Succulence | Very juicy | 5 |
| | | Juicy | 4 |
| | | Slightly dry | 3 |
| | | Dry | 2 |
| | | Very dry or watery | 1 |
| The consistency of the liquid part | Density | Normal thickness | 5 |
| | | Thick | 4 |
| | | Very thick | 3 |
| | | Very thick, flowing from pieces of meat | 2 |
| | | Very thick, does not flow from the pieces | 1 |

## Assessment of organoleptic indicators product quality using scoring scales

The process of determining the organoleptic indicators of product quality includes conducting a tasting evaluation, processing the evaluation results, and issuing a conclusion regarding product quality.

**Conducting a tasting evaluation**. Before starting work, the tasks before them are explained to the tasters. When evaluating the quality of products, tasters are guided by a developed scoring scale.

The number of tasters and the number of parallel samples examined by one person, necessary for the reliability of the work results, are calculated by the methods of mathematical statistics depending on the given accuracy of the experiment

Only appropriately prepared and coded products must be submitted for evaluation.

Each taster records the results of his work in a tasting sheet (Table 3.2).

Completed tasting sheets are sent to the technical staff to process the results.

**Table 3.2. Tasting sheet No. 1 for canned goods "Far Eastern mackerel in tomato sauce"**

| Last name, first name, patronymic of the taster _____ | | | | | | | |
|---|---|---|---|---|---|---|---|
| Place of work, position _____ | | | | | | | |
| Comprehensive indicators | Unit indicators | Evaluation of parallel product samples, points | | | | | Average value, points |
| | | 1 | 2 | 3 | 4 | 5 | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Appearance | Exposure of the vertebral bone | 4 | 4 | 5 | 5 | 4 | 4,4 |
| | The size of the pieces | 5 | 3 | 4 | 3 | 4 | 3,8 |
| | Stacking | 5 | 3 | 3 | 4 | 3 | 3,6 |
| | The integrity of each cover | 3 | 3 | 4 | 4 | 4 | 3,6 |
| | The integrity of the pieces | 4 | 4 | 4 | 3 | 3 | 3,6 |
| | Dismantling | 4 | 4 | 3 | 4 | 4 | 3,8 |
| | The color of the flesh on the fracture | 4 | 4 | 5 | 5 | 5 | 4,6 |
| | The color of tomato sauce | 4 | 4 | 5 | 5 | 5 | 4,6 |
| | Uniformity of tomato sauce | 3 | 3 | 4 | 5 | 3 | 3,6 |
| Scent | The degree of odor properties | 4 | 4 | 5 | 4 | 4 | 4,2 |
| | The degree of | 4 | 4 | 5 | 4 | 3 | 4,0 |

**Continuation of Table 3.2**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| | manifestation of the smell of additives | | | | | | |
| Taste | Degree of taste property | 5 | 4 | 5 | 5 | 4 | 4,6 |
| | The degree of manifestation of the taste of additives | 4 | 4 | 5 | 5 | 5 | 4,4 |
| The consistency of the solid part | density | 4 | 3 | 4 | 4 | 3 | 3,6 |
| | juiciness | 3 | 3 | 5 | 4 | 3 | 3,6 |
| The consistency is liquid | density | 2 | 3 | 4 | 4 | 3 | 3,2 |

**Processing of assessment results.** In the tasting sheets, the average arithmetic value of each single indicator is calculated and the results are recorded in the act given in Table 3.3.

**Table 3.3. Act of the committee on product quality assessment**

| «___» _____ 20__ г. | | | | | | |
|---|---|---|---|---|---|---|
| Canned food "Far Eastern mackerel in tomato sauce" | | | | | | |
| Complex and single indicators | Evaluation of tasters, points | | | | | |
| | 1 | 2 | 3 | 4 | 5 | Arithmetic mean value |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| *Appearance* | | | | | | |
| Exposure of the vertebral bone | 4,4 | 3,8 | 4,8 | 4,2 | 4,6 | 4,4 |
| The size of the pieces | 3,8 | 3,4 | 4,2 | 3,6 | 3,4 | 3,7 |
| Stacking | 3,6 | 3,4 | 4,6 | 3,8 | 3,2 | 3,7 |
| The integrity of each cover | 3,6 | 3,6 | 3,6 | 2,6 | 3,0 | 3,3 |
| The integrity of the pieces | 3,6 | 3,6 | 4,4 | 2,4 | 3,4 | 3,5 |
| Dismantling | 3,8 | 4,2 | 3,6 | 3,4 | 3,6 | 3,7 |
| The color of the flesh on the fracture | 4,6 | 4,6 | 4,8 | 4,4 | 4,2 | 4,5 |
| The color of tomato sauce | 4,6 | 3,8 | 4,8 | 3,6 | 4,0 | 4,2 |
| Uniformity of tomato sauce | 3,6 | 3,6 | 3,6 | 3,0 | 3,4 | 3,4 |
| | | | | | | |
| | | | | | | |

**Continuation of Table 3.3**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Overall assessment of appearance | 3,9 | 3,8 | 4,3 | 3,4 | 3,6 | 3,8 |
| *Scent* | | | | | | |
| The degree of odor properties | 4,2 | 3,6 | 4,0 | 3,4 | 3,4 | 3,7 |
| The degree of manifestation of the smell of additives | 4,0 | 3,4 | 3,4 | 3,2 | 3,6 | 3,5 |
| Overall odor rating | 4,1 | 3,5 | 3,7 | 3,3 | 3,5 | 3,6 |
| *Taste* | | | | | | |
| Degree of taste property | 4,6 | 3,6 | 4,0 | 3,2 | 3,6 | 3,8 |
| The degree of manifestation of the taste of additives | 4,4 | 3,6 | 3,6 | 2,8 | 3,8 | 3,6 |
| A general assessment of taste | 4,5 | 3,6 | 3,8 | 3,0 | 3,7 | 3,7 |
| *The consistency of the solid part* | | | | | | |
| density | 3,6 | 4,2 | 3,6 | 4,2 | 2,8 | 3,7 |
| juiciness | 3,6 | 3,6 | 4,8 | 3,6 | 3,0 | 3,7 |
| General evaluation of the consistency of the solid part | 3,6 | 3,9 | 4,2 | 3,9 | 2,6 | 3,7 |
| *The consistency of the liquid part* | | | | | | |
| Density of the liquid part | 3,2 | 3,4 | 2,8 | 3,0 | 3,8 | 3,2 |
| **General assessment of product quality** | | | | | | 3,6 |

## APPENDIX 4. Recommended scoring scales for assessment of organoleptic quality indicators of fishery products

### Table 4.1. Recommended scoring scales for assessment of organoleptic quality indicators of fishery products

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| **A. Raw fish (weight)** | | |
| *Skin-scaly covering* | | |
| Transparency of slime | Transparent, the color of the surface of the fish and the patterns on it are visible | 5 |
| | Transparent, but the color of the surface of the fish is visible with some obstacles, the patterns are visible without difficulty | 4 |
| | Slightly cloudy, the color of the surface of the fish is visible under the mucus with difficulty, and the patterns are visible quite well | 3 |
| | Cloudy, the color of the surface of the fish and the pattern under the mucus are barely visible | 2 |
| | Cloudy, only bright areas of the pattern on the surface are visible through the mucus | 1 |
| The smell of fish on the surface of the bodies | Characteristic smell of the sea without extraneous smell | 5 |
| | Characteristic smell of navaga without extraneous smell | 4 |
| | Weakly expressed, typical of the smell of navaga with a slight smell of trimethylamine | 3 |
| | There is no typical smell of navaga, a pronounced smell of trimethylamine | 2 |
| | The characteristic smell of navaga is absent, the smell of stinkdamp prevails | 1 |
| Skin color | The back is black with a dark gray pattern. The abdomen is white without a pattern. | 5 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | The lateral surface is swamp-gray, clear spots. The lateral line is not marked | |
| | The back is dark gray without a pattern. The belly is white. The lateral surface is swamp gray without spots. The lateral line is not marked | 4 |
| | The back is swamp-gray. The belly is white. | 3 |
| | The lateral surface is light gray, a new pattern has appeared in the form of light stripes marking the septa; the pattern characteristic of a freshly caught fish is not visible. The lateral line is clearly marked | |
| | The back is gray, faded. The belly is white with yellow stripes. The lateral surface is light gray | 2 |
| | The entire surface of the fish is light gray, on the belly it is whitish with a yellowish coating | 1 |
| *Gill* | | |
| Color | Pale pink | 5 |
| | Pale pink with a grayish tint | 4 |
| | Pale pink with a grayish tint, the edges of the gill petals are gray | 3 |
| | Gray, the bases of the gills are brown | 2 |
| | Brown-gray | 1 |
| Scent | Characteristic smell of the sea without extraneous smell | 5 |
| | Smells like algae | 4 |
| | Musty, reminiscent of the smell of a mud | 3 |
| | The smell of dampness | 2 |
| | Weak rotten | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| *Eyes* | | |
| Regulations on orbits | Convex around the entire perimeter | 5 |
| | The upper part of the eye closest to the head is convex, the lower third is at the level of the orbit | 4 |
| | At the level of the orbit around the entire perimeter | 3 |
| | Slightly below the level of the orbit along the entire perimeter | 2 |
| | Much below the level of orbit (sunken) | 1 |
| Transparency of the cornea | Transparent | 5 |
| | Transparent with a barely noticeable haze in the center of the eye | 4 |
| | Transparent with noticeable cloudiness in the center of the eye | 3 |
| | Blurred over the entire surface of the eye | 2 |
| | Cloudy over the entire surface | 1 |
| *Muscle tissue* | | |
| Consistence | When pressed with a finger, a hole is formed, which is leveled immediately after the mechanical impact is removed | 5 |
| | When pressed with a finger, a hole does not form | 4 |
| | When pressed with a finger, a dimple is formed, which is leveled approximately 30 seconds after the mechanical impact is removed | 3 |
| | When pressed with a finger, a dimple is formed, which is not completely leveled over time after the mechanical impact is removed | 2 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | When pressed with a finger, a pit is formed, which does not level out after removing the mechanical influence | 1 |
| The smell characteristic of navaga meat | Expressed moderately | 5 |
| | Expressed brightly | 4 |
| | Weakly expressed | 3 |
| | Barely noticeable, the weak presence of the smell of trimethylamine | 2 |
| | The smell of trimethylamine is not clearly visible | 1 |
| **B. Frozen fish (disassembled pollock, semi-finished product)** | | |
| *Appearance* | | |
| Block shape | Correct | 5 |
| | Correct with barely noticeable deviations in the thickness of the block | 4 |
| | Slight deviations from the correct form | 3 |
| | Noticeable deviations from the correct form | 2 |
| | Significant deviations from the correct form | 1 |
| Mechanical damage | There is none. With a light tap, the glaze does not come off the fish | 5 |
| | Almost none. With a light tap, the glaze slightly falls behind from fish | 3 |
| | Insignificant. When lightly tapped, a small amount of glaze falls behind | 1 |
| Uniformity of glaze applying | Homogenous. The thickness of the glaze layer is the same on all faces of the block | 5 |
| | Slight deviation from uniform. The thickness of the glaze layer differs in some places from its overall thickness | 3 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | Significant deviation from uniform. The thickness of the glaze layer is not the same over the entire surface of the semi-finished product | 1 |
| Integrity of blocks | Normal | 5 |
| | With minor integrity violations | 3 |
| | With significant integrity violations | 1 |
| Laying of fish | Dense without voids | 5 |
| | Dense with separate individual cavities | 4 |
| | Dense with minor cavities | 3 |
| | Not dense, but individual parts of fish are difficult to separate | 2 |
| | Loose, individual parts of fish are easily separated from the block | 1 |
| Separation | Correct, the cut is even, the entrails, caviar or milk are completely removed | 5 |
| | Inconspicuous deviations from correct processing | 4 |
| | Small deviations from correct processing | 3 |
| | Noticeable deviations from correct processing | 2 |
| | Significant deviations from correct processing | 1 |
| Surface color of fish | Characteristic of this type of fish: the back is gray, on the side | 5 |
| | the surface is purple-pink, the belly is white-silver with a purple tint | 4 |
| | Characteristic of this species of fish with some changes: the back is gray, the side surface is dark purple | 3 |
| | The entire surface is dull, gray, the lateral | 2 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| Fresh smell characteristic of pollock | surface is gray without shades, the belly is dirty gray | |
| | The entire surface is dull, gray in color | 1 |
| *Scent* | | |
| | Intense without extraneous signs | 5 |
| | Moderate intensity | 4 |
| | Weak: accompanied by a faint odor similar to trimethylamine | 3 |
| | Barely noticeable: an odor similar to trimethylamine prevails; absent: an intense odor similar to trimethylamine | 1 |
| *Consistence* | | |
| Density | Dense, characteristic of pollock meat: when pressing on the cut, you need to make a noticeable effort to develop deformation, the traces of which disappear slowly, but completely | 5 |
| | Compacted: when pressing on the cut, the force causing the deformation is insignificant; the depression that is formed is leveled very slowly and not completely | 4 |
| | Compacted slightly disintegrates | 3 |
| | Compacted layered | 2 |
| | Fragile | 1 |
| Succulence | Very juicy | 5 |
| | Juicy | 4 |
| | Slightly dry | 3 |
| | Dry | 2 |
| | Very dry | 1 |
| **B. Frozen fish fillet (pollock in large blocks)** | | |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| *Appearance* | | |
| Block shape | Correct, the surface of the blocks is smooth and clean | 5 |
| | Correct with minor depressions on the surface of individual blocks | 4 |
| | Correct with minor depressions on the surface of individual blocks and a slight loosening of the meat on the edge of the block | 3 |
| | The surface of the blocks is uneven, the looseness of the meat along the edge of the block is significant | 2 |
| | Significant deviations from the correct block shape | 1 |
| Mechanical glaze damage | With a light tap, the glaze does not come off the block | 5 |
| | When lightly tapped, a small amount of glaze comes off the block | 3 |
| | When lightly tapped, a significant amount of glaze comes off | 1 |
| Uniformity applying glaze | The thickness of the glaze layer is the same over the entire surface of the block | 5 |
| | The thickness of the glaze layer differs in some places from its overall thickness | 3 |
| Integrity blocks | Without violation of integrity | 5 |
| | With minor integrity violations | 3 |
| | With significant integrity violations | 1 |
| Dismantling | Correct with complete removal of bones, skin, fins, entrails, black film, blood clots, helminths and larvae | 5 |
| | Inconspicuous deviations from correct processing | 4 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | Small deviations from correct processing | 3 |
| | Noticeable deviations from correct processing | 2 |
| | Significant deviations from correct processing | 1 |
| The color of the meat | White with a grayish tint | 5 |
| | Light gray | 3 |
| | Gray | 1 |
| *Scent* | | |
| The smell characteristic of fresh meat pollock | Intensive | 5 |
| | Moderately intense | 4 |
| | Weakly expressed | 3 |
| | Barely noticeable | 2 |
| | Missing | 1 |
| *Consistence* | | |
| Density | Dense, characteristic of pollock meat | 5 |
| | Dense with barely noticeable stratification along the septa | 4 |
| | Dense with slight longitudinal delamination along the septa | 3 |
| | Stratified by septa | 2 |
| | Fragile | 1 |
| Juiciness | Very juicy | 5 |
| | Juicy | 4 |
| | Slightly juicy | 3 |
| | Dry | 2 |
| | Very dry | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| **G. Minced frozen food (special) from pollock for the production of sausage products (semi-finished products)** | | |
| *Appearance* | | |
| Block shape | Correct | 5 |
| | Slight deviations from the correct form | 3 |
| | Significant deviations from the correct form | 1 |
| Mechanical damage to the film bags of the liners | Missing | 5 |
| | Insignificant | 3 |
| | Significant | 1 |
| Integrity blocks | Without violation of integrity | 5 |
| | With minor integrity violations | 3 |
| | With significant integrity violations | 1 |
| Color | White | 5 |
| | White with a faint light gray tint | 4 |
| | White with a significant light gray or pale pink tint | 3 |
| | Light gray or pale pink | 2 |
| | Gray or pink | 1 |
| The degree of grinding to be evaluated visually | Fine grinding (by particle size) | 5 |
| | Average | 3 |
| | Rude | 1 |
| Uniformity | Homogeneous | 5 |
| | Slight deviation from uniform grinding | 3 |
| | Significant deviation from uniform | 1 |
| Inclusion of skin particles and films | Missing | 5 |
| | Isolated particles of skin and film | 4 |
| | A small amount of inclusions of skin and film particles | 3 |
| | Visible inclusions of skin and film particles | 2 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | Significant inclusions of skin and film particles | 1 |
| *Scent* | | |
| The smell characteristic of fresh meat of pollock | Odorless | 5 |
| | The smell is slightly noticeable | 4 |
| | Differs, but very weak intensity | 3 |
| | Weakly expressed | 2 |
| | Noticeably pronounced | 1 |
| *Consistence* | | |
| Density | Dense | 5 |
| | Fluffy | 4 |
| | Loose | 3 |
| Wateriness | Normal wateriness | 5 |
| | Very watery or dry | 3 |
| | Very liquid or dry | 1 |
| **D. Frozen protein paste "Ocean"** | | |
| *Appearance* | | |
| Block shape | Correct | 5 |
| | Slight deviations from the correct form | 3 |
| | Significant deviations from the correct form | 1 |
| Mechanical damage to the film bags of the liners | Absent: with a light tap, the glaze does not come off the block | 5 |
| | Minor: with a light tap, the glaze comes off the block by a small amount | 3 |
| Uniformity of the glaze coating | Uniform thickness of the glaze layer throughout the block | 5 |
| | Slight deviation of its uniform coating | 3 |
| | A significant deviation from the uniform glaze coating | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| Integrity of blocks | Normal | 5 |
| | The integrity is a little broken | 3 |
| | Integrity is significantly impaired | 1 |
| The color of the paste | Light pink or orange-red | 5 |
| | Pink or red | 4 |
| | Dark pink or dark red | 3 |
| | Pink or red with a light brown shade; pale pink or pale orange with a white tint | 2 |
| | Brown with shades of pink, orange or red, or the color of dry mustard of various shades | 1 |
| *Scent* | | |
| The smell characteristic of protein paste "Ocean" | Intense, without extraneous odors | 5 |
| | Expressed moderately without extraneous odors | 4 |
| | Weakly pronounced without extraneous odors | 3 |
| | Barely noticeable without extraneous odors | 2 |
| | Not felt, a weak smell of oxidized fat | 1 |
| *Taste* | | |
| The taste characteristic of protein paste "Ocean" | Intensely expressed, very well expressed sweet taste | 5 |
| | A distinct, sweet taste that stands out well | 4 |
| | Moderately pronounced, sweetish taste with a slightly noticeable aftertaste | 3 |
| | Weakly expressed, there is no sweetish taste, a faint pungent aftertaste is noticeable | 2 |
| | The weak taste of oxidized fat and a moderately pronounced pungent aftertaste | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | are not felt | |
| *Consistence* | | |
| Density | Coarse or syrupy, of moderate density | 5 |
| | Dense | 4 |
| | Significant density or softened | 3 |
| | Very dense or slightly greasy | 2 |
| | Very dense or greasy | 1 |
| Juiciness | Moderately juicy | 5 |
| | Somewhat excessively juicy | 4 |
| | Too juicy or slightly dry | 3 |
| | Slightly watery or dry | 2 |
| | Watery or dry | 1 |
| **E. Salted barrel fat Pacific herring** | | |
| *Appearance* | | |
| Surface color of herring bodies | Characteristic of the Pacific herring, the surface is clean and shiny | 5 |
| | Characteristic of the Pacific herring, the surface is clean, slightly shiny | 4 |
| | Typical of Pacific herring, the surface is slightly tarnished | 3 |
| | Typical of Pacific herring, the surface is tarnished | 2 |
| | Gray, dull | 1 |
| The presence of yellowing of an oxidative nature | Absent | 5 |
| | Easily removable yellow plaque on the surface of the herring (in places of consumption) | 4 |
| | Superficial yellowing that has not penetrated under the skin | 3 |
| | Superficial yellowing and slight subcutaneous yellowing that has not | 2 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | penetrated the meat | |
| | Significant subcutaneous yellowing | 1 |
| External damage | None | 5 |
| | Broken gill covers, cracks and small breaks in the skin | 4 |
| | Broken gill covers, cracks, skin breaks | 3 |
| | Broken gill covers, cracks, skin breaks and mechanical head injuries | 2 |
| | Significant damage | 1 |
| Integrity belly | Normal | 5 |
| | The abdomen is slightly distended, the insides are slightly exposed | 4 |
| | A ruptured abdomen with considerable exposure of the entrails | 3 |
| | The abdomen burst, the insides were exposed without falling out | 2 |
| | The abdomen burst, with the entrails falling out | 1 |
| *Scent* | | |
| The degree and severity of the herring smell | Intensely expressed without signs of deterioration | 5 |
| | Expressed moderately without signs of spoilage | 4 |
| | Weak intensity without signs of deterioration | 3 |
| | Barely noticeable, sour smell in the gills | 2 |
| | There is no sour smell in the gills | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| The degree of manifestation of the smell of oxidized fat | Missing | 5 |
| | Present | 3 |
| | Massive | 1 |
| *Taste* | | |
| Herring-like taste | Characteristic of herring | 5 |
| | Intensive | 3 |
| | Moderate, barely noticeable | 1 |
| *Consistence* | | |
| Density | Dense | 5 |
| | Soft | 4 |
| | Weak | 3 |
| | Weak or hard | 2 |
| | Very stiff or limp | 1 |
| Succulence | Juicy | 5 |
| | The sign of juiciness is expressed moderately, dryness is not felt | 4 |
| | Slightly dry | 3 |
| | Dry | 2 |
| | Very dry | 1 |
| **Z. Cold-smoked salmon fish** | | |
| *Appearance* | | |
| Dismantling | Correct: the fish is cut along the belly between the pectoral fins from the front part of the belly to the anus; entrails, blood clots, caviar or milk are removed; the internal cavity is cleaned | 5 |
| | Correct with barely noticeable deviations from disassembly | 4 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | Correct with minor deviations from correct processing | 3 |
| | Significant deviations from correct processing | 2 |
| | Improper processing | 1 |
| Mechanical damage | Missing | 5 |
| | Some units have inconspicuous cracks in the abdominal cavity | 4 |
| | Some units have slight cracks in the abdominal cavity and slight exposure of the rib bones | 3 |
| | A significant number of fish have cracks in the abdominal cavity and slight exposure of the rib bones | 2 |
| | Most of the fish have cracks in the abdominal cavity, considerable exposure of the rib bones | 1 |
| Blockiness of scales | Absent | 5 |
| | Slight damage on individual specimens of fish | 4 |
| | Most of the fish are slightly messed up | 3 |
| | Partial mess in most fish | 2 |
| | The scales are messed up in most fish | 1 |
| Wrinkles | Absent | 5 |
| | Slight | 3 |
| | Significant | 1 |
| Detachment of the skin from the meat | Not available | 5 |
| | Partial | 3 |
| | Significant | 1 |
| Moisture of surface | The surface is dry | 5 |
| | Barely moisturized, but not wet | 3 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | Slightly wet surface | 1 |
| Salt coating | Missing | 5 |
| | Barely visible on small areas of the surface in individual fish | 4 |
| | Insignificant on small areas of the surface of individual fish | 3 |
| | Slight in gill covers, eyes and base of caudal fin | 2 |
| | Significant in gill covers, eyes and base of caudal fin | 1 |
| Protein-fat inflows | Missing | 5 |
| | Single on the surface of individual fish | 4 |
| | Small on the surface of individual fish | 3 |
| | Significant on the surface of fish | 2 |
| | Common on most of the surface of fish | 1 |
| The color of scaly cover | Golden | 5 |
| | Light or dark golden | 4 |
| | Light or dark golden | 3 |
| | Brown | 2 |
| | Light brown or pale | 1 |
| *Scent* | | |
| Smokey smell of fish | Expressed moderately | 5 |
| | Expressed intensively | 4 |
| | Expressed weakly or excessively | 3 |
| | The pungent smell of smoked fish | 2 |
| | The smell of smoke or dampness | 1 |
| *Taste* | | |
| The taste characteristic of smoked meats | Expressed moderately | 5 |
| | Expressed intensively | 4 |
| | Expressed weakly or excessively | 3 |
| | Barely noticeable | 2 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | Absence of taste characteristic of smoked meats, aftertaste of dampness | 1 |
| *Consistence* | | |
| Density | Dense | 5 |
| | Compacted | 4 |
| | Slightly soft or hard | 3 |
| | Soft or hard | 2 |
| | Soft or very hard | 1 |
| **3. Hot smoked Pacific herring** | | |
| *Appearance* | | |
| Juiciness | Juicy | 5 |
| | Too juicy | 4 |
| | The sign of juiciness is weakly expressed, but dryness is not felt | 3 |
| | Slight dryness, the texture is slightly brittle when cut | 2 |
| | Dry or very brittle when cut | 1 |
| Mechanical damage | Missing | 5 |
| | Barely noticeable cuts and breaks in the skin in individual specimens | 4 |
| | Some specimens have broken gill covers, broken heads, small breaks and cuts in the skin | 3 |
| | Many fish have broken gill covers, broken heads, small breaks and cuts in the skin, small damage to the abdomen and swelling of the skin, up to 3% of fish with broken heads | 2 |
| | The vast majority of fish have broken gill covers, significant breaks and cuts of the skin, damage to the abdomen, significant | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | swelling of the skin, the number of fish with damaged heads exceeds 3% | |
| Rugosity skin | Absent | 5 |
| | Lung | 3 |
| | Significant | 1 |
| Moisture surface | The surface is dry | 5 |
| | Slight surface wetting | 3 |
| | The surface is wet | 1 |
| Fat build-up | Missing | 5 |
| | Single ones are just noticeable on individual copies | 4 |
| | Inconspicuous | 3 |
| | Small | 2 |
| | Significant | 1 |
| Surface color herring bodies | Golden | 5 |
| | Pale golden | 4 |
| | Yellow or golden with a dark shade | 3 |
| | Dark golden or straw yellow | 2 |
| | Brown or straw | 1 |
| Uniformity color | Level | 5 |
| | Uniform with single light spots (skin areas not covered by smoke) on individual carcasses | 4 |
| | Uniform with single light spots (skin areas not affected by smoke) | 3 |
| | Minor light spots (skin areas not affected by smoke) | 2 |
| | Significant light spots (skin areas not covered by smoke) | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| Uniformity color | Level | 5 |
| | Uniform with single light spots (skin areas not covered by smoke) on individual carcasses | 4 |
| | Uniform with single light spots (skin areas not affected by smoke) | 3 |
| | Minor light spots (skin areas not affected by smoke) | 2 |
| | Significant light spots (skin areas not covered by smoke) | 1 |
| Degree of readiness of the product | Fully ready: meat, caviar or milk is cooked without signs of moisture; the meat is easily separated from the spine, the blood is completely coagulated | 5 |
| | Fully cooked, but slightly overcooked | 3 |
| | With some signs of dampness | 1 |
| *Scent* | | |
| The degree of property and expressiveness | Characteristic of hot smoked herring. Moderately expressed | 5 |
| | Expressed intensively | 4 |
| | Expressed weakly or excessively | 3 |
| | Barely noticeable | 2 |
| | The presence of the smell of smoke or the absence of a smell characteristic of hot smoked herring | 1 |
| Presence of smell of oxidized fat | Missing | 5 |
| | Barely perceptible in separate areas of the subcutaneous layer, it is not felt in the meat | 4 |
| | Barely noticeable in the entire subcutaneous layer, it is not felt in the | 3 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | meat | |
| | It is slightly felt in the subcutaneous layer, it is not felt in the meat | 2 |
| | Significant in the subcutaneous layer | 1 |
| *Taste* | | |
| The taste characteristic of hot smoked herring | Intensive | 5 |
| | Moderately expressed | 4 |
| | Expressed weakly or excessively | 3 |
| | Barely perceptible | 2 |
| | Missing | 1 |
| *Consistence* | | |
| The consistency of hot smoked herring | Juicy | 5 |
| | Too juicy, but not watery | 4 |
| | The sign of juiciness is weakly expressed, but there is no dryness | 3 |
| | Dry and slightly brittle | 2 |
| | Dry and brittle or watery | 1 |
| **I. Canned dishes "Far Eastern fish ragout in natural juice"** | | |
| *The appearance of the fish* | | |
| Stacking | Correct: unlined, the jar contains at least 50% pieces of the occipital part of the heads and tusks, and up to 50% of the caudal, occipital, etc. | 5 |
| | Minor deviations from correct stacking | 3 |
| | Significant deviations from correct stacking | 1 |
| Integrity of pieces | Normal, do not fall apart when taken out of the can | 5 |
| | Normal, in isolated cases the pieces are slightly broken when laying out from the can | 4 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | Individual pieces fall apart when you take them out of the can | 3 |
| | A small number of pieces fall apart when taken out of the can; the presence of grated meat on the surface of the pieces near the bottom and lid of the jar | 2 |
| | The vast majority of pieces fall apart when taken out of the jar; a large amount of grated meat on the surface of the pieces near the bottom and lid of the jar | 1 |
| The color characteristic of boiled | Bright | 5 |
| | Moderately bright | 4 |
| Fish meat | Pale | 3 |
| | A small number of dark specks and spots on the surface of the pieces, and in the case of red sockeye - also inside the pieces of meat | 2 |
| | A significant number of dark specks and stains on the surface and inside the pieces of meat | 1 |
| *The appearance of the broth* | | |
| Color | Light, transparent, with the presence of fat drops | 5 |
| | Light, slightly cloudy from suspended particles of fish protein, with the presence of fat droplets | 4 |
| | Light, cloudy from suspended particles of fish protein, with the presence of fat droplets | 3 |
| | Light, cloudy from suspended particles of fish protein | 2 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | Cloudy | 1 |
| *Scent* | | |
| Characteristic of boiled meat of Far Eastern salmon fish | Expressed intensively | 5 |
| | Expressed moderately | 4 |
| | Weakly expressed | 3 |
| | Barely noticeable | 2 |
| | Not noticeable | 1 |
| *Taste* | | |
| Characteristic of boiled meat of Far Eastern salmon fish | Intense without bitterness | 5 |
| | Moderately expressed without bitterness | 4 |
| | Expressed weakly without bitterness | 3 |
| | Barely noticeable without bitterness | 2 |
| | Not felt, a noticeable aftertaste of bitterness | 1 |
| *Consistence* | | |
| Characteristic of boiled meat of Far Eastern salmon fish | Pieces of fish meat are juicy, the bones of the back of the head are soft (easily rubbed between the fingers) | 5 |
| | The juiciness of pieces of fish meat and skewers is expressed moderately, the bones of the back of the head are soft (rubbed between the fingers) | 3 |
| | Pieces of fish meat are dry, the bones of the back of the head are hard (not completely rubbed between the fingers) | 1 |
| **K. Canned food "Saury in oil" (blanched)** | | |
| *The appearance of the fish* | | |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| Laying fish at the bank | Correct: the pieces are stacked tightly in cross sections to the bottom and lid, the back parts of the pieces are located against the wall of the jar | 5 |
| | Correct with barely noticeable deviations | 4 |
| | Correct with minor deviations | 3 |
| | Significant deviations from correct stacking: the fish is laid loosely, some pieces are located at an angle | 2 |
| | Incorrect: most of the pieces in the jar are located at an angle, the stacking is loose | 1 |
| Fish processing | Correct: head, entrails and tail fin removed | 5 |
| | Correct with barely noticeable deviations from correct processing | 4 |
| | Correct with minor deviations from correct processing | 3 |
| | Significant deviations from correct processing: in some specimens of fish there are remains of entrails | 2 |
| | Improper processing: in most pieces of fish there are remains of entrails | 1 |
| Evenness of pieces cut | Even, smooth | 5 |
| | In minor sections of the cut of individual pieces, there are irregularities | 4 |
| | Irregularities of the cut in separate areas in a significant part of the pieces | 3 |
| | Individual pieces of fish have an oblique cut | 2 |
| | Most pieces of fish have oblique cuts | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| Integrity of pieces | Normal, when carefully laid out from the can, do not fall apart | 5 |
| | Normal, in separate cases, the pieces may break slightly when carefully laying out the fish from the can | 4 |
| | Individual pieces of fish fall apart when carefully removed from the can | 3 |
| | A significant number of pieces fall apart when carefully removed from the can | 2 |
| | Most pieces of fish fall apart when carefully removed from the can | 1 |
| The size of the pieces | The same length and corresponding in height to the inner height of the can | 5 |
| | Slight deviation in the length of individual pieces and their height mismatch with the internal height of the can | 3 |
| | A significant difference in the length of the pieces and the deviation from normal height to the inner height of the can | 1 |
| Integrity of skin coverings | Normal | 5 |
| | Normal with barely noticeable violations in separate areas | 4 |
| | Normal, on individual pieces of fish a little broken | 3 |
| | Partial damage to the skin in a significant number of pieces of fish | 2 |
| | Significant damage to the skin in most pieces of fish | 1 |
| The presence of scales | Absent | 5 |
| | There are single scales | 3 |
| | A significant amount of scale is present | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| Baking of skin to the inner surface of the can | Absent | 5 |
| | Baking of the skin in a small area | 4 |
| | Baking of the skin in several (two or three) places on a small area | 3 |
| | Baking of the skin in a large number of pieces of fish | 2 |
| | Baking of the skin in the majority of pieces of fish | 1 |
| *The appearance of the filling (oil)* | | |
| Oil after settling | Transparent, settling itself in the lower layer, there is very little of it | 5 |
| | Transparent with the presence of sediment in the lower layers | 3 |
| | It is slightly cloudy, a significant amount of it settling in the lower layers | 1 |
| *Scent* | | |
| The smell characteristic of saury in oil | Expressed intensively | 5 |
| | Expressed moderately | 4 |
| | Weakly expressed | 3 |
| | Barely noticeable | 2 |
| | Not noticeable | 1 |
| The degree of manifestation of the spices smell | Moderately pronounced harmonic smell of a mixture of spices (bay leaf and black pepper) | 5 |
| | The smell of spices is intense or weak | 3 |
| | The smell of spices is very strong or not felt | 1 |
| *Taste* | | |
| The taste characteristic of saury in oil | Intensive | 5 |
| | Moderately expressed | 4 |
| | Weakly expressed | 3 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | Barely noticeable | 2 |
| | It is not felt | 1 |
| *Consistency of the solid part of canned goods* | | |
| Density | Dense | 5 |
| | Dense, individual pieces are soft | 4 |
| | Soft | 3 |
| | The pieces are slightly boiled | 2 |
| | Soft, boiled | 1 |
| Tenderness | Gentle | 5 |
| | Extremely delicate, close to ointment-like | 4 |
| | Expressed not intensively enough | 3 |
| | Weakly expressed, close to slightly hardened | 2 |
| | Tough | 1 |
| Juiciness | Juicy | 5 |
| | Excessively juicy, some wateriness | 4 |
| | Weakly expressed, but dryness is not felt | 3 |
| | Slight dryness | 2 |
| | Slightly dry | 1 |
| | Incorrect: most of the pieces in the jar are located at an angle, the stacking is loose | 1 |
| **L. Canned food "Sprats in oil"** | | |
| *The appearance of the fish* | | |
| Laying fish in can | Correct: fish carcasses are arranged in parallel, mutually intersecting rows; in a row, each fish is placed head to tail in relation to the neighboring one; the fish is packed with bellies to the lid and bottom of the can | 5 |
| | Correct: with barely noticeable deviations from the correct stacking, it is possible to | 4 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | stack the fish with the undercut belly with the backs against the bottom and lid of the can | |
| | Correct with minor deviations | 3 |
| | Significant deviations from correct stacking | 2 |
| | Improper stacking | 1 |
| Dissecting fish | Correct: fish have their heads removed with a straight or oblique cut; scale, caudal fins removed completely or trimmed, part of the fin that remains no more than 5 mm | 5 |
| | Correct with barely noticeable deviations from correct processing, tail fins are trimmed, the part of the fin that remains can be more than 5 mm | 4 |
| | Correct with minor deviations from correct processing, tail fins left | 3 |
| | Deviations from correct processing are significant | 2 |
| | Incorrect disassembly | 1 |
| Fish integrity | Whole, when carefully laid out from the can, they do not break | 5 |
| | Whole, but individual fish break when taken out of the can | 3 |
| | A significant number of fish break during the release from the can | 1 |
| The size of the carcasses | The carcasses are of the same length in the jar | 5 |
| | The carcasses differ in length by no more than 20 mm. | 3 |
| | The carcasses differ in length by more | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | than 20 mm | |
| Integrity of skin coverings | Whole | 5 |
| | Whole with minor violations in individual fish | 4 |
| | No more than 30% of fish have partially slipped skin | 3 |
| | More than 30% of fish have partially slipped skin | 2 |
| | Slipped skin in most fish | 1 |
| The presence of scales | Absent | 5 |
| | The presence of single scales on the skin of fish | 4 |
| | The presence of a certain number of scales on the skin of fish | 3 |
| | The presence of a significant amount of scales on the skin of fish | 2 |
| | The scales are not removed | 1 |
| Integrity of belly | All fish are whole | 5 |
| | Baked in individual fish | 4 |
| | No more than 30% of the fish are baked | 3 |
| | Baked in more than 30% of fish or cut in all fish | 2 |
| | Most of the fish are baked | 1 |
| *Skin color* | | |
| Skin color of coverings, characteristic of smoked fish in oil | Golden yellow, homogeneous | 5 |
| | Dark golden, homogeneous | 4 |
| | Light or dark golden, heterogeneous | 3 |
| | Brown, heterogeneous | 2 |
| | Dark brown, heterogeneous | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| *The appearance of the oil* | | |
| Appearance of oil characteristic of smoked fish in oil | Transparent after settling, settling in the lower layers and there is very little sediment in them | 5 |
| | Transparent after settling, in the lower layers there is sedimentation of moisture and suspended particles | 3 |
| | After settling, the oil is slightly cloudy, there is a significant amount of moisture and sediment, suspended particles in the lower layers | 1 |
| *Scent* | | |
| Smoked scent of fish in oil | Expressed moderately | 5 |
| | Expressed intensively | 4 |
| | Expressed weakly or excessively intensively | 3 |
| | A distinct scent of smoke | 2 |
| | The sharp scent of smoke or the absence of a scent characteristic of smoked fish | 1 |
| *Taste* | | |
| Smoked taste of fish in oil | Intense taste | 5 |
| | Moderately pronounced taste characteristic of smoked fish | 4 |
| | The characteristic taste of smoked fish is expressed weakly or excessively | 3 |
| | There is a taste of bitterness | 2 |
| | Absence of the taste characteristic of smoked fish, or a significant aftertaste of bitterness | 1 |
| *The consistency of fish* | | |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| Tenderness | Gentle | 5 |
| | Extremely delicate, close to ointment-like | 4 |
| | The sign of tenderness is not expressed intensively enough | 3 |
| | The sign of tenderness is weakly expressed (the consistency is closer to slightly stiff) or the fish is partially overdone | 2 |
| | Hard or overdone | 1 |
| Juiciness | Juicy | 5 |
| | Excessively juicy (some wateriness is observed) | 4 |
| | The sign of juiciness is weakly expressed, but dryness is not felt | 3 |
| | Moderate dryness | 2 |
| | Slightly dry | 1 |
| **M. Canned pollock in oil and tomato sauce** | | |
| *The appearance of the fish* | | |
| Placing fish in cans | Correct, neat: the pieces are placed in cross sections to the bottom and lid of the can | 5 |
| | Correct with inconspicuous deviations from correct laying | 4 |
| | Correct with minor deviations from correct laying | 3 |
| | Significant deviations from correct stacking | 2 |
| | Incorrect: some pieces are located in the jar at an angle or flat | 1 |
| Dissecting fish | Correct: head, fins, entrails, blood clots, black film, nibelinium larvae and | 5 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | nematodes, remains of caviar or milk have been removed from the fish | |
| | Correct with barely noticeable deviations from correct processing | 4 |
| | Correct with minor deviations from correct processing | 3 |
| | Deviations from correct processing are significant: in some pieces of fish there are remnants of a black film, caviar or milk | 2 |
| | Improper processing: in most pieces of fish there are remnants of a black film, caviar or milk, single blood clots | 1 |
| Evenness of cut pieces | Equal | 5 |
| | Separate sections are wried | 3 |
| | Most pieces of fish have wried cuts | 1 |
| Integrity of pieces | Whole | 5 |
| | Whole, but in isolated cases, when carefully laid out, pieces of fish fall apart | 3 |
| | A significant number of pieces fall apart when carefully removed from the can | 1 |
| The size of the pieces | The uniformity of the dimensions, the height corresponds to the internal height of the can | 5 |
| | A certain discrepancy of individual pieces in length, the height of one part of the pieces corresponds to the inner height of the can, and the other is lower than it by 4-5 mm | 3 |
| | A significant part of the pieces is lower than the inner height of the can by 6 mm | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | or more | |
| The protrusion of the vertebral bone above level of meat | Missing | 5 |
| | It protrudes no more than half of the vertebra | 4 |
| | The same for one vertebra | 3 |
| | The same for one and a half vertebrae | 2 |
| | More than one and a half vertebrae | 1 |
| Integrity of skin coverings | Whole | 5 |
| | Whole with barely noticeable irregularities on single areas of the surface | 4 |
| | Whole, some pieces are slightly broken | 3 |
| | Partial damage to the skin on a significant number of pieces of fish | 2 |
| | Significant damage to the skin on most pieces of fish | 1 |
| *The appearance of the filling* | | |
| The color of the water part fillings | Light gray with a bright orange shade | 5 |
| | Light gray with an orange tint | 4 |
| | Light brown with an orange tint | 3 |
| | Light brown or light gray | 2 |
| | Dark gray or brown | 1 |
| Oil color of parts of the filling | Orange | 5 |
| | Yellow-orange | 4 |
| | Red or orange | 3 |
| | Red with a brown tint or pale yellow | 2 |
| | Red-brown or brown | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| Oil color of parts of the filling | Orange | 5 |
| | Yellow-orange | 4 |
| | Red or orange | 3 |
| | Red with a brown tint or pale yellow | 2 |
| | Red-brown or brown | 1 |
| *Scent* | | |
| Degree related to expressiveness of the smell characteristic of pollock in oil-tomato filling | Expressed moderately | 5 |
| | Expressed intensively | 4 |
| | Expressed weakly or excessively | 3 |
| | Barely noticeable | 2 |
| | Not noticeable | 1 |
| Degree of Manifestations of the additives smell | Harmonic, expressed moderately | 5 |
| | Harmonic, but expressed excessively intensively | 4 |
| | Harmonic, but weakly expressed | 3 |
| | The smell of individual components (acetic acid or oil) prevails | 2 |
| | A pronounced smell of acetic acid or vegetable oil | 1 |
| *Taste* | | |
| Degree of expressiveness | The taste characteristic of pollock in an oil-tomato filling. Expressed intensively | 5 |
| | Expressed moderately | 4 |
| | Weakly expressed | 3 |
| | Barely noticeable | 2 |
| | Not felt | 1 |
| | The taste of individual additives is not felt | 5 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| The degree of manifestation of the taste of additives | There is a slight aftertaste of acetic acid | 4 |
| | There is a taste of certain additives (acetic acid or vegetable oil) | 3 |
| | There is a taste of certain additives (acetic acid or vegetable oil) | 2 |
| | A pronounced taste of acetic acid or vegetable oil | 1 |
| *The consistency of fish* | | |
| Density | Dense | 5 |
| | Dense, individual pieces are soft | 4 |
| | Soft or slightly hard | 3 |
| | Soft or hard | 2 |
| | Hard or boiled | 1 |
| Juiciness | Juicy | 5 |
| | Excessively juicy, there is some wateriness | 4 |
| | The sign of juiciness is weakly expressed, but dryness is not felt | 3 |
| | Dry or moderately watery | 2 |
| | Dry and watery | 1 |
| **N. Preserves "Herring ivasi, special salting"** | | |
| *Appearance* | | |
| Integrity of skin coverings | Whole | 5 |
| | Minor cracks in the skin in the front part of the abdomen | 4 |
| | Violation of the integrity of the skin in the front part of the abdomen | 3 |
| | Violation of the integrity of the skin in the abdominal area from the tailbone to the tail fin | 2 |
| | Violation of the integrity of the skin, | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | mostly on the surface | |
| Integrity of belly | Whole, dense | 5 |
| | Whole, but weakened | 4 |
| | Small cracks in the abdomen, through which the entrails are not visible | 3 |
| | The abdomen burst slightly, without the entrails falling out in individual fish | 2 |
| | Abdomen that burst, with entrails falling out | 1 |
| Mechanical damage | Missing | 5 |
| | Significant damage to the gill covers in some species | 3 |
| | Significant damage to the gill covers | 1 |
| The presence of scales | Not available | 5 |
| | Single scales on individual specimens of fish | 4 |
| | Single scales on most fish | 3 |
| | Slight presence of scales on the whole fish | 2 |
| | A significant amount of scales on the whole fish | 1 |
| The presence of fat that has been released on the surface of the fish | Not available | 5 |
| | Separate areas of individual units of fish are covered with a small amount of fat | 4 |
| | Certain areas of most fish are covered with a small amount of fat | 3 |
| | A small amount of released fat covers the surface of the fish | 2 |
| | A significant amount of fat that has been released on the surface of the fish | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| *The color of the surface of the fish* | | |
| Degree of expressiveness | Silver-blue color, shiny, no yellowing | 5 |
| | Blue without shine, not tarnished, no yellowing | 4 |
| | Dark color with a blue color on the back, white color on the belly, silver tone and shine are absent, yellowing | 3 |
| | Dull, dark surface on the back, white on the belly, slight yellowing of an oxidative nature | 2 |
| | Dull, dark surface on the back, light on the belly, noticeable yellowing of an oxidative nature | 1 |
| Scent | | |
| Degree of expressiveness | Expressed brightly without the smell of dampness | 5 |
| | Expressed moderately without the smell of dampness | 4 |
| | Weakly pronounced, there is a faint smell of overripe preserves or the smell of dampness | 3 |
| | Just perceptible, there is a noticeable smell of dampness or overripe preserves | 2 |
| | There is a sour smell of overripe ones preserved or raw immature fish | 1 |
| The smell of oxidized fat | Missing | 5 |
| | It is barely noticable in the head area | 4 |
| | Weak over the entire surface of the fish | 3 |
| | Moderately expressed over the entire surface of the fish | 2 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| | Significantly expressed over the entire surface of the fish | 1 |
| Taste | | |
| Degree of expressiveness | Brightly expressed | 5 |
| | Moderately expressed | 4 |
| | Weakly pronounced, there is a slightly stinging aftertaste | 3 |
| | There is a pungent taste of overripe preserves or the taste of unripe herrings | 2 |
| | The taste of overripe herrings prevails | 1 |
| The taste of oxidized fat | Missing | 5 |
| | Absent in muscle tissue, it is barely detected in the subcutaneous layer | 4 |
| | Absent in muscle tissue, weak in the subcutaneous layer | 3 |
| | It is barely detected in the muscle tissue, moderately expressed in the subcutaneous layer | 2 |
| | Significantly expressed | 1 |
| *Consistence* | | |
| Density | Dense along the entire length, when squeezing the fish on the back, the meat springs back noticeably | 5 |
| | Dense along the entire length, when squeezing the fish on the back, the meat springs weakly | 4 |
| | The fish is soft in the main part, dense in the tail part | 3 |
| | Soft along the entire length of the fish | 2 |
| | Soft | 1 |

**Continuation of Table 4.1**

| Organs, tissues and their indicators | Verbal description of quality | Points |
|---|---|---|
| Tenderness | Very gentle | 5 |
| | Gentle | 4 |
| | The tenderness is weak or the meat is very tender | 3 |
| | There is no tenderness or the meat is slightly greasy | 2 |
| | There is no tenderness or the meat is greasy | 1 |

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# SENSORY ANALYSIS

## Basic Textbook