V МІЖНАРОДНА НАУКОВО-ПРАКТИЧНА ОНЛАЙН КОНФЕРЕНЦІЯ

ТЕНДЕНЦІЇ ТА ВИКЛИКИ СУЧАСНОЇ АГРАРНОЇ НАУКИ В УМОВАХ ВІЙНИ: ТЕОРІЯ І ПРАКТИКА

Присвячена 125-річчю кафедри рослинництва НУБІП України

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TRENDS AND CHALLENGES OF MODERN AGRICULTURAL SCIENCE: THEORY AND PRACTICE

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Рекомендовано до друку збірник тез доповідей V Міжнародної науково-практичної онлайн конференції: «Тенденції та виклики аграрної науки в умовах війни» Присвяченої 125-річчю кафедри рослинництва НУБіП України вченою радою агробіологічного факультету Національного університету біоресурсів і природокористування України від 16 листопада 2023 року протокол № 11.

Тенденції та виклики сучасної аграрної науки в умовах війни: теорія і практика. **Присвячена 125-річчю кафедри рослинництва НУБІП України** матеріали V міжнародної науково-практичної онлайн конференції (м. Київ, 25-27 жовтня 2023 р.)/НУБІП України, 2023. 339 с.

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У збірнику опубліковано матеріали доповідей учасників V міжнародної наукової інтернет-конференції «Тенденції та виклики сучасної аграрної науки в умовах війни: теорія і практика», яка присвячена 125-річчю кафедри рослинництва НУБІП України. Висвітлено теоретичні і практичні питання сучасної аграрної науки, напрями їх вирішення та впровадження у виробництво.

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ASSESSMENT OF BIOMASS TORREFACTION BY MASS LOSS DURING HEAT TREATMENT AT DIFFERENT MODES

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The main sources of biomass are agricultural waste and residues (straw, stalks and rods of corn, stalks and husks of sunflower), as well as energy crops (willow, poplar, miscanthus), which are grown specifically for this purpose. Increasing the volume of such raw materials is an agronomic issue, and in the field of improving the energy properties of biomass there are already significant successes, but scientific research is still underway. The main obstacles to the use of plant biomass as a solid fuel are then some of its physical characteristics: low energy density, heterogeneity, particle size, etc. The peculiar chemical-physical properties, which appear as highly variable shape, size, moisture content, density, chemical composition (different proportion and nature of the hemicellulose, cellulose and lignin) and high concentrations of minor species, such as chlorine, alkali metals, nitrogen and sulphur, strongly modify the reactivity of both the starting material and the intermediate products of the decomposition and gasification processes.

The production of standardised upgraded biomass with low cost technology will definitively constitute a prerequisite to produce biofuels rather than the use of raw biomass.

One of the ways to obtain a product with such properties from biomass is its torrefaction - the process of "soft" pyrolysis of biomass, heating without access of air, which takes place at temperatures of 200-320 C and atmospheric pressure for 15-30 minutes.

It continues the work on the scientific topic "Agrobiomass of Ukraine as an energy potential of Central and Eastern Europe" (registration number 0119U103056) at the Higher educational institution «Podillia State University», the joint Ukrainian-Polish educational and scientific laboratory "DAK GPS". The main activity of the laboratory is to improve the energy performance of biomass by thermal treatment (torrefaction), which results in torrefied products. Investigations of the primary signs of the state of heat-treated raw materials were carried out on a plant for torrefaction of tape-type biomass with passive interaction with the material. This method minimizes the physical and mechanical effects on the raw material, and the flow of the process allows to get the most homogeneously processed product.

Selected biomass samples using laboratory scales were divided into equal-weight portions of 50-100 g, which were alternately subjected to heat treatment at seven temperature regimes: 180, 200, 220, 240, 260, 280 and 300 C. The temperature range 180-300 fully meets the conditions of the torrefaction process.

To bring the data to a more traditional form, it is necessary to build thermogravimetric curves in addition to the weight loss curves. To construct the curves, the loss in mass of the substance during heating to high temperatures is determined. The curve of the dependence of mass loss on temperature is plotted in the coordinates of the abscissa - temperature, ordinate - mass loss in grams or percent (Fig. 1). Such a curve called simple or integral shows all the mass loss from the beginning to the end of heating.

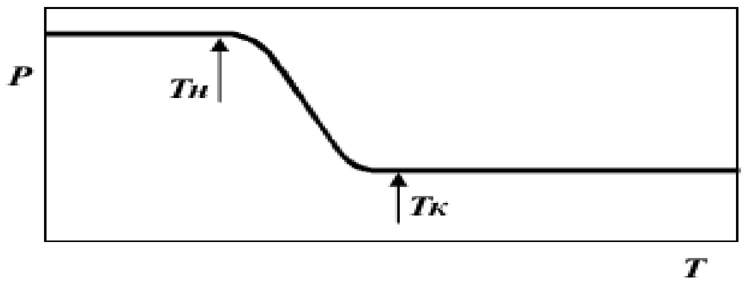

Fig. 1. Characteristics of the TG curve in the case of a one-stage reaction

In Fig. 1 shows the characteristics of the curve of mass reduction in the case of a single-stage reaction. For any one-stage nonisometric reaction, you can choose two characteristic points on the TG curve: a) the initial decomposition temperature Tn, ie the temperature at which the total change in mass reaches the sensitivity of thermobalances; b) the final temperature Tk, ie the temperature at which the total change in mass reaches a maximum value corresponding to the completion of the reaction. The difference Tk-Tp is called the reaction interval. These threshold values will determine the start and end modes of torefication.

To determine the parameters of weight loss at different processing temperatures, a number of studies were conducted for different types of raw materials. The results of measurements of relative weight loss are shown in Fig.2.

Analyzing the graphs, we see that the dynamics of changes in weight loss depending on the thermal treatment temperature for different biomass occurs on similar principles. At the initial stage, the curve is almost horizontal, or with a slight slope toward growth, depending on the initial humidity of the material. Obviously, as in the case of thermogravimetric curves at this stage is the removal of free moisture and drying of the material.

Thus, the control of weight loss and discoloration of biomass subjected to thermal treatment can be parameters of the initial assessment of the modes of torrefaction and the quality of torrefaction.

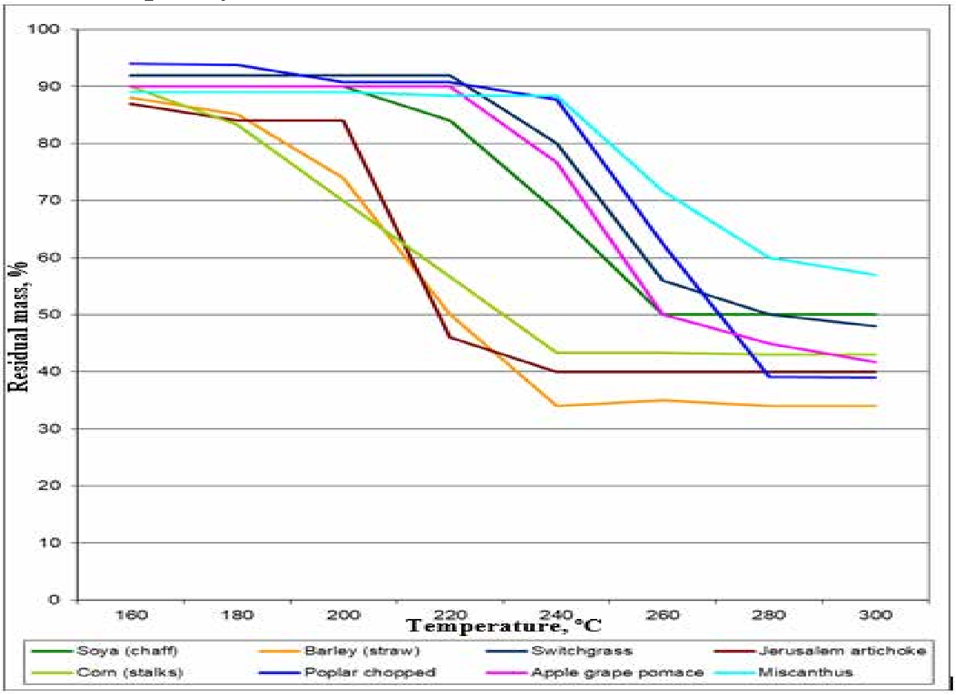

Fig. 2. Integral thermogravimetric curves of torefication of different types of biomass.

And this in turn will allow without the presence of complex equipment in the production environment with sufficient accuracy to determine the necessary modes of torrefaction.

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