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ИССЛЕДОВАНИЕ ТОПЛИВНЫХ ХАРАКТЕРИСТИК ОТХОДОВ ЛЬНОПРОИЗВОДСТВА

RESEARCH OF FUEL CHARACTERISTICS OF WASTE PRODUCTS OF FLAX PRODUCTION

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Аннотация. Проведен анализ возможности использования отходов льнопроизводства в качестве источника энергии. Представлены результаты исследования топливных характеристик отходов льнопроизводства, изучена возможность брикетирования данного вида отходов.

Ключевые слова: производство энергии, отходы льнопроизводства, теплота сгорания топлива, влажность топлива, зольность топлива, брикетирование отходов.

Abstract. The analysis of the possibility of using the waste products of flax production as an energy source has been carried out. The results of a study of the fuel characteristics of waste products of flax production are presented, the possibility of briquetting of this type of waste products is studied.

Key words: energy production, waste products of flax production, fuel calorific value, fuel moisture content, fuel ash content, waste briquetting.

Introduction. Due to the limited fuel and energy resources, a significant role for the Republic of Belarus is assigned to the production of energy from local sources of raw materials. In accordance with the State Program «Energy Saving» for 2021–2025 their share in gross consumption should be at least 16.5 % [1]. Waste products of flax production are considered as a possible source of energy in this paper. Flax is one of the industrial crops of the Republic of Belarus. Analysis of statistical data [2] shows that in the Republic of Belarus there is a tendency to increase the area under flax. So, in 2015, the sown area was 45 thousand hectares, and in 2020 – 49 thousand hectares. Gross flax harvest in farms of all categories of the republic in the period from 2015 to 2020 increased by 14.5 % and amounted to 48 thousand tons. In the course of mechanical processing of flax raw materials on machines, production waste is formed – flax shive. Taking into account that the output of flax fiber during the primary processing of raw materials is about 30 %, the share of flax waste products formed during the technological process accounts for about 70 %. Considering the data on the gross flax harvest for 2020 (48 thousand tons), the generation of waste products of flax production subject to secondary processing amounted to 33.6 thousand tons.

Main part. To analyze the possibility of using flax shive as fuel, the following studies of the main fuel characteristics were carried out: humidity, ash content, heat of combustion, which determines the energy value of raw materials.

Determination of moisture content of flax shive was carried out in accordance with the procedure [3] by the main method. The flax shive sample was crushed to 1–2 cm, after it was dried in an electric heated oven at a temperature of 105–110 ºC. Next, the loss of the mass fraction of moisture was determined. The average moisture content of the analyzed samples of flax was 9.6 %.

The determination of the ash content was carried out by the main method in accordance with [3] in a muffle furnace by ashing a sample with flax shive and calcining the ash residue in crucibles. The average dry fuel ash content was 2.8 %.

The calorific value was determined by the calorimetric method in accordance with [4]. The total calorific value of the flax shive was calculated based on the weight of the sample, the heat capacity of the calorimetric system, and the increase in water temperature in the vessel of the measuring chamber [5]. According to the results of the studies, the highest calorific value of the analyzed samples of flax shive was 18.21 MJ/kg, and the lowest calorific value was 16.68 MJ/kg, which is a rather high value.

The disadvantage of using flax shive as a fuel is its low density. In this regard, experimental studies were carried out on the possibility of pressing flax shive. The feedstock was pressed on a PSU-125 press. The mechanical process of pressing the feedstock was carried out in a special mold, consisting of a cylindrical matrix and a stamp. Before pressing, the raw material was weighed. Next, the mass and thickness of the obtained experimental fuel briquettes were determined, and their density was determined by means of calculation. It has been established that during pressing, the density increases by 6-7 times.

Conclusion. The results of determining the main fuel characteristics of the flax shive make it possible to substantiate the possibility of its use as a renewable fuel. It has a rather high calorific value, low humidity (up to 25 %) and relatively low ash content. Experiments on the briquetting of waste products of flax production found that flax shive can be briquetted, both in pure form and with the use of additives. The use of waste products of flax production in the fuel balance of enterprises will allow saving fuel and energy resources and reducing the cost of production by reducing energy costs.

REFERENCES

1. Государственная программа «Энергосбережение» на 2021–2025 гг. Утв. постановлением Совета Министров Республики Беларусь от 24.02.2021 г. № 103.

2. Сельское хозяйство Республики Беларусь. Статистический сборник. – Мн., 2021. – 179 с.

3. Торф. Методы определения влаги и зольности: СТБ 2042-2010.

4. Топливо твердое минеральное. Определение высшей теплоты сгорания и расчет низшей теплоты сгорания: ГОСТ 147-2013. – М., 2019. – 52 с.

5. Зеленухо, Е.В. Оценка эффективности использования вторичных топливных ресурсов при производстве энергии: сборник материалов второго молодежного экологического форума. Кемерово, 2014. – С. 138–143.

6. Казакевич, П.П. Совершенствование технологий производства и переработки льна-долгунца и льна масличного. – Мн., 2016. – 184 с.

7. Озеров, А.Н. Энергетическое топливо и физико-химические основы горения. – Новочеркасск.: ЮРГТУ (НПИ), 2007. – 308 с.