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STUDY PHYSICAL AND MECHANICAL PROPERTIES PILE AS OF BIOFUEL AS ALTERNATIVE

***Комаха Віталій Петрович**, к.т.н., доцент*
***Янович Віталій Петрович**, к.т.н., доцент*
Вінницький національний аграрний університет
Komacha V.
Yanovich V.
Vinnytsia National Agrarian University

***Summary*:** *in this paper, attention is drawn to the problem of disposal of waste arising during cleaning grain pile coming from bunkers harvesters - seeds (parts of stems) weeds, straw, chaff and other residues of crops. Examples of its use as a solid biofuel are given. Displaying basic physical and mechanical properties of the toughest parts of pile.*
Keywords: *pile, pellets, pellets, extrusion, solid biofuels.*

Introduction

In world practice in the energy balance of the most economically developed countries in the use of gas for electricity and heat is not more than 20-25% [1]. Among these countries there is a general tendency to switch to energy use in non-conventional renewable energy, as evidenced by radical revision process energy strategies. More than 73 countries have adopted such programs [2-5], the results of which is the share of renewable energy in the energy sector of the European Union in the period of 2010-2035 should grow at least 2 times: from 840 in 2010 to 1680 in 2035 [6]. In some EU countries to achieve this goal a number of measures on the state level power producers that have obliged are developed to increase the share of renewable resources as fuel. Failure to comply with these measures is punishable by huge fines.

Solving problems involving energy balance of Ukraine and improve the economic efficiency of local resources, low-grade organic substance materials in agricultural production is an important task of researches.

Formulation of the problem

Grain pile coming from bunkers harvesting or threshing, consists of basic grain culture, weed seeds, straw, chaff and parts of stems. However, while clearing a huge amount is accumulated - from several tons to several tens of tones (depending on the power of winnowing complex type head). Most pile (husk) taken to landfill, while there is a problem with transportation – weight and low bulk pile ability to spontaneous combustion, rotting, creating an unpleasant smell and severely worsen the ecological situation if resort to burning. Because of the low bulk weight farms take significant transport costs pile to landfill volume is for the average farm is 11-16% [7].

The realization that major gains are brought to moisture conditioning to bring the main crop production – the most in need of – corn. Baled pile is a real alternative to traditional fuels in its heating value characteristics, and on environmental parameters.

Decision of the problem of the involving energy balance of local resources with low-grade organic bio-substance is based on their manufacturing process in bio-fuels is an important task of research in the area of energy conservation and energy independence in agricultural production.

The purpose of the article

Energy saving by using bio-substance – the study of physical and mechanical properties pile that can be used in the energy balance of local resources with low-grade organic bio-substance based on their manufacturing process in biofuels.

Presenting the main material

Traditional methods of burning fuel for energy purposes in appliance to low-grade material - biomass associated with certain difficulties – drying equipment is not adapted for the usage of high-moistured and high-fuels, because of complication of the complex fuel burner a heating and heating surfaces, reduced reliability smoke exhausts reduced ash creators, and increased repair costs [8-10]. Moreover, pile fragility and certain types of biomass resulting in high quantities by burning failure. As a result, energy use of low-grade materials accompanied by high operating costs, making it impossible to use pile in drying equipment.

By modern methods of energy production that can effectively recycle low grade bio substance, combustion in a fluidized bed can be included [11], the use of low-temperature vortex furnaces [12] conversion [13] or catalytic combustion. [14] However, the following methods require a minimum significant investment to replace or upgrade existing equipment at the moment, which leads to long payback period. This situation shows the need to continue to seek ways of processing low-grade biofuels for efficient energy use.

Today, the most promising direction for objects «small» energy for the agricultural enterprises is processing low-grade bio substance to composite solid fuel (CSF), such as briquettes, pellets, granules and so on. Interest in this area is caused by that CSF due to improved thermal performance for high combustion efficiency and economy, it does not need to invest in the modernization construction of dryers. CSF production in Ukraine started in the early twentieth century, but in the second half of the development of this trend stalled due to the low cost of oil and gas. Since the late 90s to the present, processing raw materials in CSF again causing concern, as evidenced by the number of plants for its production (production lines Ruf, Nestro, Pini & Kay, Zhasko et al.). A large number of patents and publications on the subject.

CSF is used for auxiliary boiler farms. The main disadvantage of CSF in modern production of low-grade materials is the usage in energy-intensive stage of forming stamping, which cost sometimes exceeds half the cost of the entire production line. This leads to high production costs and not under competitive in the energy market prices: higher cost of manufactured CSF compared to analog low-grade fuels from organic material. Reduction efforts are needed in the formation CSF, leading to the use of sticky substance that allows the use of less energy-intensive pressing device and, therefore, reduce the cost of equipment, thereby reducing the production cost of fuel from bio-substance.

In addition, technological approach of processing low-grade bio-substance, necessary to its physical and mechanical analysis. As pile heterogeneous composition (weed seeds, chaff of the stem), for the installation of necessary consolidation efforts will conduct research for the most solid component. According to the analysis of pile is a stem (see. Fig. 1).

Fig. 1. The test samples

The remains of the stem in pile characterized by heterogeneity; cuticized the outside (covered with a dense film) and inlaid silicon. The coefficients of friction of various parts of the stems that are in pile are about similar, for example, in wheat, barley and other major crops.

Efforts to break the stems as much is 187-196 H, deformed, as in our case, 120-140 H, chaff 107-39 N. The presence of seeds and stalks of weeds parts increases the strength of the entire 25-40%.

Pile stiffness is within (245-588) · 104 N / m^2. With increasing pile humidity stiffness decreases - in humidity of 65%, it is (120-300) · 104 N / m^2, which ensured the introduction of a total weight of mortar.

The stems of crops are elastic, compared with stems of weeds critical bend radius ranging from 10 to 45 mm. Average specific work of cutting the stems of weeds is 9,6 · 103 J / m^2, straw cereals – (3-7) · 103Dzh / m^2. This increase in the proportion of characterizing the increased strength stems of weeds.

As a result of separation of the grain mass of stems in satin pile are ready for extrusion composition has the following specifications:

- Bulk density of about 180-200 kg / m^3;
- The average length of the major components pile – 0.5-1 cm;
- Shape factor ~ 5.10;
- Flowability 45°.

Table 1

The generalized structure investigated pile shown in the table.

Components	Cellulose	Lihin	Pentosan	Aqueous extract	Resins, fats, wax	Ash
Contain, %	42-44	20-22	9-11	3-5	4-6	16-18

Ash, which is ballast in pile is formed by burning. The composition and properties of ash depend on the conditions of combustion. When burning on open air, that is, in conditions of oxidative medium, ash, which is dominated by silicon as the main component will be from 80 to 90% of the total content. Ash content vary depending on the silica, and the number and the type bio-substance mode of combustion. When the content of the active silica to 80% by weight, the range of values of this index within the parameters of combustion can be from 40 to 95% [16]. Thus, the basic parameters of the burning of low-grade biofuels are the temperature and duration of combustion.

There are several methods of burning, which are divided into controlled and uncontrolled. By way of uncontrolled burning methods include the natural flow of air needed for combustion and controlled way with regulated supply of air for combustion pile.

Chemical analysis of ash is obtained by controlled burning pile shows its decrease – at 20%.

Advantages of received products (CSF) the following:

- Versatility, allowing the use of a wide range of CSF fuel-melting layer device type;
- High calorific value significantly reduces fuel during combustion;
- High strength, which is formed by introducing mortar will reduce the impact of CSF hygroscopic and will maintain its integrity during the loading and unloading of the transport and supply to the boiler furnace, thereby reducing the value of the failure-iron through play;
- Environmental friendliness;
- Saves moisture during storage facilities and CSF preparation for burning.

However, the implementation of the principle of recycling pile requires further research and optimization of parameters of thermal heating and forming processes using highly CSF pressing equipment.

Conclusions and suggestions

So the basic idea is the local processing of low-grade substance for high-calorie foods by forming CSF. The main advantages of this processing are as follows:

- Starting material is available in local renewable low-grade raw materials – pile;
- The process in terms of recycling economy will avoid additional investment in the proof of product to humidity conditioning;
- Organization pile processing into biofuel reduces environmental pollution;
- Use as adhesive mortar, which will reduce the impact of water absorption bio-substance and is compared with other types of relatively cheap and accessible substance.

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ДОСЛІДЖЕННЯ ФІЗИКО-МЕХАНІЧНИХ ВЛАСТИВОСТЕЙ ВОРОХУ В ЯКОСТІ ЗАСТОСУВАННЯ ЯК АЛЬТЕРНАТИВНОГО ВИДУ БІОПАЛИВА

Анотація: *у даній роботі звернено увагу на проблему утилізації відходів, які виникають при очищенні зернового вороху, що надходить з бункерів комбайнів - насіння (частин стебел) бур'янів, соломи, полови або інших залишків культурних рослин. Наведено приклади його використання як твердого біопалива. Відображено основні фізико-механічні властивості найбільш міцних складових частин вороху.*

Ключові слова: *ворох, паливні гранули, пелети, пресування, тверде біопаливо.*

ИССЛЕДОВАНИЕ ФИЗИКО-МЕХАНИЧЕСКИХ СВОЙСТВ ВОРОХА В КАЧЕСТВЕ ПРИМЕНЕНИЯ КАК АЛЬТЕРНАТИВНОГО ВИДА БИОТОПЛИВА

Аннотация: *в данной работе обращено внимание на проблему утилизации отходов, образующихся при очистке зернового вороха, поступающего из бункеров комбайнов - семена (частей стеблей) сорняков, соломы, половы или других остатков культурных растений. Приведены примеры его использования в качестве твердого биотоплива. Отражены основные физико-механические свойства наиболее крепких составных частей вороха.*

Ключевые слова: *ворох, топливные гранулы, пеллеты, прессование, твердое биотопливо*.