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Освещаются актуальные проблемы влияния мировой экономики на развитие инновационных тенденций, состояние и перспектива развития законодательства, филологические и лингвистические аспекты образования, современные производственные и информационные технологии.

Издание представляет интерес для широкого круга специалистов сферы образования, аспирантов, студентов.

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Straw as a fertilizer. Straw addition to use as a feed is used for other purposes.. Currently in farms produce large surpluses of straw mainly caused by the increased participation of cereals in the crop structure. Otherwise it can be exploited to avoid incurring necessary costs of harvesting, transport and storage. The straw have a high value fertilizer and as a fertilizer is still undervalued, as evidenced by often seen burning in the fields after harvest crops. The Polish soils are poor in humus, and important is the development of any quantity of organic matter that is not used for fodder purposes. In the area of 1 ha produces around 4-6 t straw cereals. In such an amount of straw is on average 30 kg of nitrogen , 12 kg phosphorus , 62 kg of potassium , 7 kg magnesium , 17 kg calcium and trace elements. But the most important component of the straw is an organic substance, which formed in the soil humus and soil fertility index. Five tons of dry matter straw contains about 4.8 t of organic matter. However, using straw as a fertilizer, we must remember by the high C:N ratio, which is an average of 80:1, whereas, the fodder in plants is in the range 20:1 to 10:1 and in the soil. The introduction of organic matter to the soil deficient of in nitrogen causes of nitrogen biological immobilization microbial biomass. After plowing straw soil microorganisms proliferate intensively using to build his body easily available at the moment nitrogen, coming from under-utilized mineral fertilizers, and then fold soil organic matter. This process leads to periodic immobilization of nitrogen. To ease the process, it is necessary to use with the straw of mineral nitrogen in the amount of 7 - 10 kg N per 1 t of straw ploughing (eg, 100 kg of urea per 1 ha). Condition for the effective distribution of straw as a fertilizer is appropriate its fragmentation (about 10 cm) and uniform scattering in the field and mix it with the soil. Straw should be cut into sections of a length of about 10 cm. Important is also the depth of plowing straw. Decomposition processes proceed preferably straw when the straw is plowed shallow depth of about 10 - 12 cm. It is important especially on soils compaction and humid (kpodr.pl).

Conclusion. Processing methods of straw can be physical, chemical and biological. Physical treatment of feed components as drying, grinding, hydrothermal treatment, the operation of the various chemical compounds, including ensiling forage, the addition of acids, bases or organic compounds, affects the physical and chemical properties of the fiber. Change the structure of the building crude fiber and its use by livestock. Such a method of treating feed also influences its overall digestibility. Examples include granulation, expanding, grinding and extrusion. As a result of these processes resulting in improved digestibility of the feed, and thus the utilization of nutrients by the animal, which is of great importance in particular when the increase (kpodr.pl). Straw as organic fertilizer directly comminuted crop at harvest or after the knives to be successfully applied. However, one should remember to keep balance the C:N in straw. In countries with high overproduction of straw, also still looking for other methods of management. In addition to these uses can be used in the energy industry as a renewable energy source (Kościk, 2003).

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DENSIFICATION OF PLANT MATERIAL WASTE WITH POTATO PULP CONTENT

Introduction. A big source of energy from biomass is the post-production waste (e.g. buckwheat hulls, oat bran, fruit pomace, rapeseed pomace, herbal waste, agriculture waste e.g. straw). These types of waste are only utilised to a small extent and they often constitute a serious problem to particular processing plants.

Biomass is the most important source of energy and according to scientist (Sotannde 2010) contributes between 20 and 40 mln t of oil equivalent to annual energy consumption.

The most often practical methods for managing plant biomass waste is its densification (pelletisation and briquettisation) into a solid fuel form (pellets, briquette) (Hejft 2002; Skonecki and Laskowski 2012; Mani et al., 2006, Shaw 2008; Kaliyan and Morey 2009).

The main parameters of the obtained pellets are their density and kinetic durability, which are influenced by a number of factors, e.g. content of the densified mixture, or the amount of binder additives. These factors also significantly influence the pelletisation process and its energy consumption.

Materials and research methods. The paper presents the results of a research study on the process of densification of plant waste: buckwheat hulls and oat bran in a mixture with potato pulp which is a remnant of washing out starch from potatoes. The tests of the densification process of the investigated mixture were carried out on a SS-4 work stand whose main component is a P-300 pellet mill with a flat matrix (Obidziński 2014). The SS-4 stand was equipped with a universal meter for measuring the electric power demand of the device, and with a Spider 8 recorder connected to a computer. Signals from the universal meter were transmitted to the Spider 8 recorder in the form of binary files which were further processed using the Microsoft Excel software.

The research on the densification process consisted of three stages:

– preparing the mixtures of buckwheat hulls and oat bran with the appropriate amounts of potato pulp and determining the moisture content of the obtained mixtures (after 24 hours);

– densification of the prepared mixtures in the working system of the pellet mill and recording the results;

– determining the kinetic durability of the obtained pellets (24 hours after leaving the working system).

The tests on the densification of the mixtures with potato pulp were conducted for the working gap between the densification roll and the matrix of h_r=0.4 mm, at mass velocity of the mixtures of approx. Q_s=75 kg·h^{-1} and rotational speed of the matrix of n_m=230 rpm. The diameter of the openings in the matrix used in the tests was d_o=8 mm, while their length was l_o=28 mm.

During the tests the influence of potato pulp content (z_w=15%, 20% and 25%) in a mixture with buckwheat hulls, oat straw and oat bran on the electric power consumption of the engine driving the pellet mill as well as on the kinetic durability of the obtained pellets were determined.

The kinetic durability of the obtained pellets was determined pursuant to PN-R-64834:1998, 24 hours after the pellets had left the working system, using Holmen's tester (Obidziński and Hejft 2013, Obidziński 2014). During the tests, each time a pellets sample weighing 100 g was placed in the tester chamber where it was exposed to a stream of air and, circulating in it, was hitting on the perforated metal walls of the tester. The pellets were kept in the chamber for 60 s. The kinetic durability of the pellets was calculated as the ratio of the mass of the pellets after the test to the mass of the pellets before the test.

Results. Fig. 1 presents the results of the research of the influence of potato pulp content in a mixture with buckwheat hulls and oat bran on the electric power demand of the pellet mill recorded during mixture densification.

On the basis of the obtained test results (fig. 1), it can be concluded that increasing the content of potato pulp in a mixture with oat bran from 15 to 25% caused a significant reduction of the electric power demand of the pellet mill by approx. 39% (from 3.09 to 1.88 kW). Increasing the content of potato pulp in a mixture with buckwheat hulls from 15 to 25% caused a reduction of the electric power demand of the pellet mill by approx. 35% (from 2.73 to 1.78 kW).

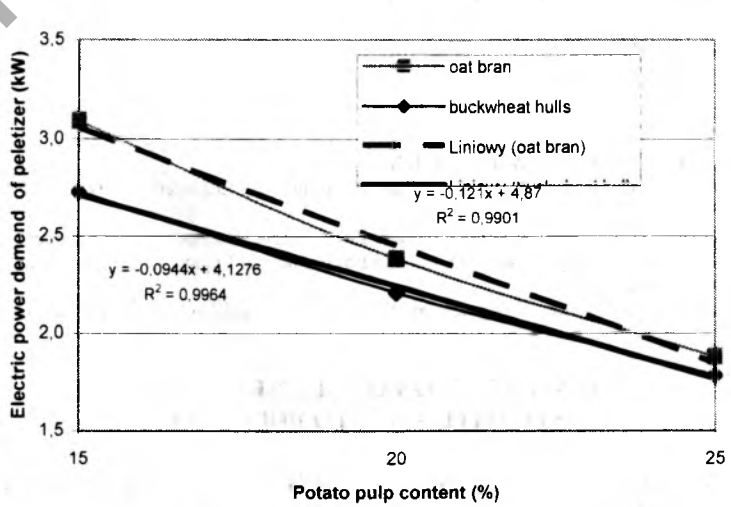

Fig. 1 — The influence of potato pulp content in a mixture with buckwheat hulls and oat bran on the electric power demand of the pelletizer

The reduction of the electric power demand of the pellet mill is caused by the significant increase of the moisture content of the mixture resulting from the increased content of potato pulp. Increasing the pulp content resulted in obtaining bigger and bigger amounts of binder (in the form of a liquid produced from starch and moisture) during the pelletisation process. The produced binder caused a reduction of the resistance to forcing through the opening and, at the same time, lowering the values of the electric power demand of the pellet mill (fig. 1), also simultaneously increasing the density and kinetic durability of the obtained pellets, which after cooling and gelatinisation of starch into a sticky gel, produced a dense agglomerate.

Fig. 2 presents the results of the research of the influence of potato pulp content in a mixture with buckwheat hulls and oat bran on the values of kinetic durability of pellets determined using Holmen's method.

On the basis of the conducted research (fig. 2), it can be concluded that as the pulp content in a mixture with oat bran and buckwheat hulls increases from 15 to 25%, the value of the kinetic durability of the pellets decreases.

The tests performed in the working system of the pellet mill allow to conclude that the most beneficial content of pulp as an additive to oat bran and buckwheat hulls, from the point of view of pellets quality, is below 20%, as it allows to obtain high quality pellets (pellets of high kinetic durability). Increasing the pulp content above 20% results in a reduction of the kinetic durability below 90%, which renders them less attractive from the energetic point of view.

Conclusions. Increasing the content of potato pulp in a mixture with oat bran and buckwheat hulls from 15 to 25% caused a reduction of the pellet mill's demand for electric power and reduction of the kinetic durability of the pellets. The most beneficial content of pulp as an additive to oat bran, from the point of view of the electric power demand of the pellet mill, also considering the high quality of the obtained pellets, is 20%, as it makes it possible to reduce significantly energy consumption of the process (in comparison to the pulp content of 15%), simultaneously making it possible to achieve a satisfactory quality of the pellets (kinetic durability of over 90%). The most beneficial content of pulp as an additive to oat bran, from the point of view of pellets quality, is 15%, as it allows to obtain high quality pellets (with kinetic durability of over 95%).

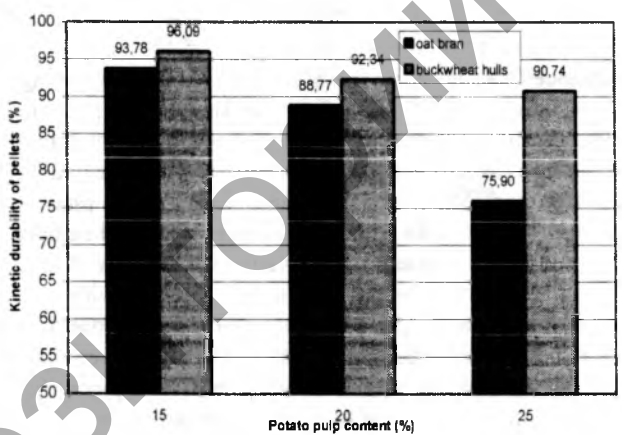

Fig. 2 — The influence of potato pulp content in a mixture with buckwheat hulls and oat bran on values of kinetic durability of pellets

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