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INVESTIGATION OF STEM PLANTS DEFORMATION PROPERTIES OF THE GRAIN PILE

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Summary: *in this work the strength component of pile - stalk, where it is completely crushed. Established that deformation values stem mass of plants that will allow for efficient consolidation efforts to provide the necessary compression, in turn will reduce mechanical efforts in the production of low-grade fuel from substance materials of plant origin.*

Keywords**:** *pile, pellets, extrusion, solid bio-fuels.*

Introduction

Everywhere in Ukraine problems of energy are vital, demand for energy grows, and supplies of traditional fuels are very limited, are steadily becoming more expensive, while viability is accompanied by recycling wastes: wood, agricultural, lignin and others. Mountains of which are growing rapidly and represent a serious threat of our time.

Energy – is the foundation of the economy, so the concept of [1] involvement in the fuel balance numerous large-combustible waste streams are becoming more relevant. For example, when cleaned grain pile coming from bunkers harvesting or threshing grain and consists of the main crop, parts of stems, weeds, straw, chaff and other crops accumulate in large quantities - from several tons to several dozen. Most pile is taken to landfill (Draw. 1), while there is a problem during transportation - low bulk density, ability to spontaneous combustion, rotting, which creates an unpleasant smell and severely make the ecological situation worse if resort, to its burning. Because of the low bulk density farms are significant transport costs pile to landfill volume is for the average farm is 11 ... 16%.

In our opinion, in Ukraine the most effective use of energy and recycling, as local fuel with the use of the place of education is economically advantageous only from the point of view of lack of transportation costs.

Formulation of the problem

When exposed to normal pile doesn't differ from the solid system and has complete resistance to compression. In this case, perpendicular current efforts are passed through the solid particles in ground contact. This stems particles dispersed and similar materials are elastic and plastic properties, and therefore at their pressing need to consider the time of the load. Obviously, while loose seal pile its particles are subjected to additional grinding and grinding, which helps to create greater contacting surface.

Analysis of the main research and publications

The most efficient way of recycling pile, which allows not only avoid unnecessary costs, but also receive additional income is production on the basis of solid bio-fuels (pellets or briquettes) followed by their implementation. Pellets are features of the combustion process in which the heat is at the minimum amount of harmful substances released. In the EU plant material has been long and successfully used as a kind of alternative industrial fuel for energy, and now the demand for solid bio-fuel far outstrips supply [2].

The most effective way of producing solid bio-fuels is pressing, as this final moisture content of the finished product will make a total of 8 - 12%, and the starting material is compacted by 8 - 10% [3]. Pressed bio-fuels have a number of other advantages, among which consistency of quality performance is mentioned, ease of storage, the use in heating systems with automatic fuel supply.

Main part

Pile samples were taken after cleaning cereals (wheat) and industrial crops (sunflower) (Draw. 1). After the inspection conducted fractional measurements: length of the largest plant residues with the aid metric ruler and divided it roughly into three parts; diameter aid calipers. Separating the total weight of pile stalk with the help of scissors cut a piece of 1 cm in length.

Fig. 1. Pile were taken after cleaning cereals and industrial crops

With the help of device [4] to determine the strength of various parts of the stem compression, consisting of loading screw mechanism, which is rigidly attached pressing court, and its light from 0,01mm point value, which in turn is placed on a desktop. The value of the effort applied to the sample type is displayed on the dynamometer DPU-0.02-2. Measurements of strain and effort of compression performed as follows: sample length of 1 cm placed on the supporting platform which is attached to dynamometer.

Through the pressing platform that is tightly attached to the screw mechanism conducted compression of the sample, the efforts of which is shown on the dynamometer. Moving pressing fixed platform with the help of the indicator. Dynamometer and indicator indexes and in the indicator carry the research protocol for further cultivation.

To determine the deformation modulus at the time of crushing the following formulae are used [5]:

$$Epl = qpl / \varepsilon pl \quad (1)$$

where *qpl* – conventional compression;

εpl – relative deformation.

$$qpl = Fpl / (b \cdot d), \quad (2)$$

where *Fpl* – efforts that should be put to full sample crush, N;

b – the length of the plot on which the force F, m;

d – diameter, m.

$$\varepsilon pl = l / d, \quad (3)$$

where *l* - the absolute compression deformation city.

The data processed by means of spreadsheet "Excel". Constructed depending *Δst = =f·(Fst),*

where *Δst* – deformation of the sample, mm;

Fst – effort compression kN.

Draw graphic dependency analysis (Draw. 2) transverse compression without restrictions on the sides of various designs. For sample №1 part of the stem at the site of compression force from 0 to 0,032 kN rectilinear dependence observed that by further increasing the load to 0,034 kN moves in curvilinear, which begins crushing deformation.

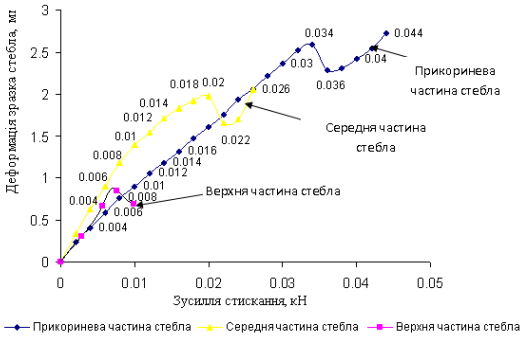

Fig. 2. Dependence of strain samples pile components of the applied force

Further sample №1 squeezed and cracks appear on its surface. With further increase the load to 0,036 kN wall pattern finally merge.

Drawing transverse compression standard №2 compared to the schedule transverse compression standard №3 been more intense deformation is observed and growth effort at 0.02 kN sample completely compressed.

Analyzing graphics compression cross different samples observed that schedule compression standard №4 has a different view. The chart shows that with increasing load strain grows slowly and cracks. With the growing efforts enhanced crushing and comes a moment when in the diagram force is equal to 0,008 kN when the material breaks.

This difference in the survey sample compression is caused by different structure of their set (Draw. 3).

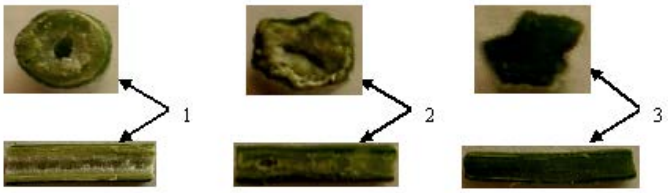

Fig. 3. Cross-section and longitudinal samples of various different parts of the stem pile 1 – sample №1; 2 – sample №2; 3 – sample №3

As seen in drawing 3, the sample №1 has a clear cavity, №2 partially filled, and the like №3 has a solid cross-section filled completely. Through the graphical dependencies strength characteristics can be defined. We are interested in the strength of stems particles that are in pile *Epl* by which the sample is completely compressed.

According to formulas (1, 2 and 3) and graphics compression (Draw. 2) *Epl* for different parts of the stem pile will be between 1,3·106 N/m^2 to 0,87·106 N/m^2.

Conclusions

Results of the work permit:

- Justify the rational parameters of the process;
- To ensure the quality of their formation fuel from biological materials;
- Reducing energy consumption for production of bio-fuels from low-grade raw materials;
- To improve design decision in the design of stamping.

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ДОСЛІДЖЕННЯ ДЕФОРМАЦІЙНИХ ВЛАСТИВОСТЕЙ ЧАСТИН СТЕБЛА РОСЛИНИ ЗЕРНОВОГО ВОРОХУ

Анотація: *у даній роботі досліджено міцність складової частини вороху – стебла, при якій воно повністю роздавлюється. Встановлено, деформаційні значення стеблової маси рослин, що надасть можливість для якісного ущільнення забезпечити необхідні зусилля стискання, що в сою черга приведе до зменшення механічних зусиль при виробництві палива з низькосортної сировини рослинного походження.*

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

ИССЛЕДОВАНИЕ ДЕФОРМАЦИОННЫХ СВОЙСТВ ЧАСТЕЙ СТЕБЛИ РАСТЕНИЙ ЗЕРНОВОГО ВОРОХА

Аннотация: *в данной работе исследованы прочность составной части вороха - стебли, при которой оно полностью раздавливается. Установлено, деформационное значение стеблевой массы растений, что позволит для качественного уплотнения обеспечить необходимые усилия сжатия, в сою очередь приведет к уменьшению механических усилий при производстве топлива из низкосортного сырья растительного происхождения.*

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