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CREATION OF NEW TECHNOLOGY OF COAL BRIQUETTE MANUFACTURING

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ABSTRACT

In this article, the results of designing and determining the main dimensions of a screw press for coal briquetting are presented.

KEYWORDS: ***biocomponent, coal briquettes, smokelessly, biofertilizer.***

DISCUSSION

Naturally occurring coal dust during coal mining and coal dust generated during coal transportation cause many inconveniences to consumers. Coal powder is briquetted using dry and wet methods in order to make it fit for consumption. In wet briquetting, a binding biocomponent was used as a briquette to increase the starch and flammability of rice, which is a local industrial waste [1].

Sooner or later, any enterprise engaged in the sale or processing of any coal will face the problem of collecting coal ash and dust.

About 20-30% of the total mass of coal is a powder fraction of up to 6 mm, and it is usually difficult to use this raw material as a fuel. One of the most effective ways to solve this problem is to use it in the production of coal briquettes from coal dust and fine particles.

The use of efficient technology of coal briquetting allows to obtain high-quality and competitive coal briquettes from a small fraction of coal. Production of coal briquettes using organic additives (cattle manure) and liquid binder (rice starch solution), which are effective and environmentally friendly binders, is one of the promising methods. Coal briquettes are high-tech Coal compared to ordinary coal. Coal charcoal briquettes with organic additives and binders are an environmentally friendly product that burns almost smokelessly, making it an ideal fuel for heating rooms of various sizes. Coal briquettes are used as coal to heat stoves, fireplaces, all types of stoves, tents, greenhouses and more. The main advantages of coal briquettes are their long burning time and stability of the combustion process, as well as ease of storage in narrow storage conditions.

The team of authors has developed a technology for the production of coal briquettes with high mechanical and environmental performance. The essence of the developed method of preparation of coal briquettes involves crushing of coal fraction and biocomponent component (cattle manure). In the mixer, these dry components of the briquette are mixed intensively in a ratio of 80:20, and then at the end of the mixing process is completed with the addition of a liquid binder. This liquid binder is an aqueous solution of rice starch and polyacrylamide in a ratio of 40: 1. The resulting mass is transferred to the precipitate, resulting in the processes of adhesion and structure formation in the mass, as well as biochemical reactions. The result is high mechanical parameters of the finished product. After the soaking time, the finished mass is sent to the shaping and drying process. [2,3]

In the process of dry briquetting of coal powder, coal powder is initially separated into fractions. In this method of briquetting, it is recommended to use a powder that is very fine, less than 2 mm in size. If the briquette contained particles larger than the specified size, cracks were observed

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in these parts after briquetting. When obtaining briquettes using the dry method, due to the absence of briquettes in the briquette, it is necessary to operate the pressing apparatus under high pressure. This in turn leads to increased energy consumption. We have developed a technological scheme of the line for the wet production of coal briquettes (Figure 1).

As you can see from the technological scheme, each device in the technological line is inextricably linked with each other.

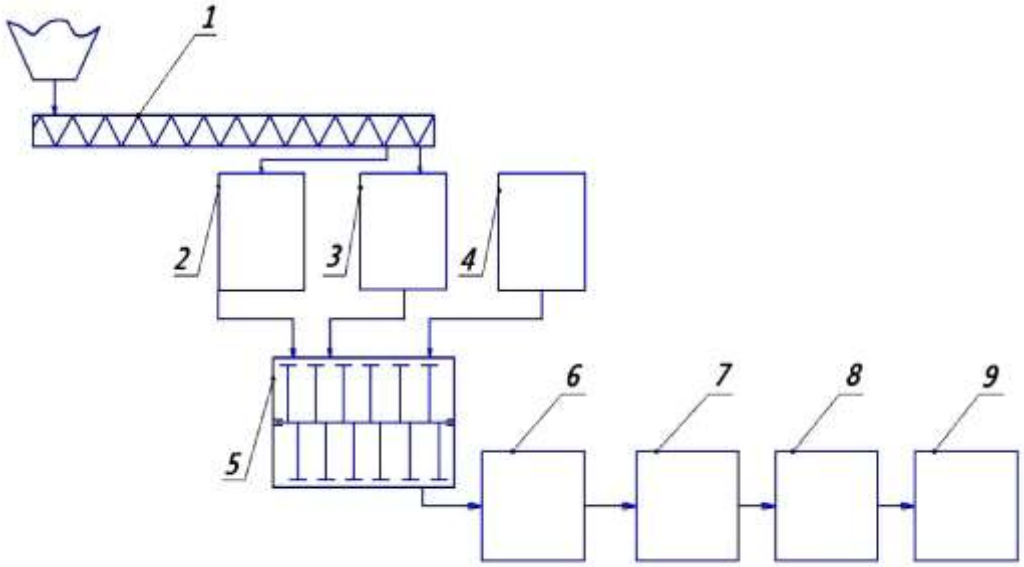

Figure 1. The main technological scheme of production of coal briquettes based on bioorganic binders:

1 - grinder; 2 - bunker for fine coal fraction; 3 - bunker for binding biocomponent (cattle manure); 4 - container for liquid binder; 5 - mixer; 6 - protective pipe; 7 - forming machine; 8 - drying chamber; 9 - warehouse.

Coal briquettes obtained by this method have high mechanical properties. This method grinds a small piece of coal fraction in a grinder (1) (Fig. 1). In this case, the reduction of coal particles to a size of 1 mm is achieved. The resulting pulverized coal fraction is collected in the trenches for the fine coal fraction (2). Once a sufficiently small fraction of coal has accumulated, the crusher (1) passes on to crush the biofertilizer, which is added as a component to increase the strength. This crushed product is collected in a bunker (3). Volume (4) contains a liquid binder consisting of a mixture of water, starch and polyacrimadil in a ratio of 40: 1. The dry mixture serves to give consistency: in the container (4) to be a binder liquid, based on an aqueous solution of 40 polyacrylamide and starch ratio. From the mixer (5) bowl (2) and the dry component of the bowl (3) and the liquid mixture from the bowl (4) in the ratio of 80:20 is added. Top mixing is continued until a homogeneous paste mixture is formed. In turn, it helps to distribute the components evenly over the mass. The resulting mass is sent to the maturation hopper (6). Adhesion, structuring, and many chemical processes take place there.

Biochemical reactions result in high mechanical parameters of the finished product. After maturation, the mass is transferred to the shaping machine (7). Coal briquettes are produced in various shapes and sizes by individual order of consumers. The shaped briquettes are then placed in the atmosphere in the first stage, which helps to save heat energy. The final stage of drying can be carried out in the open air under the influence of summer sunlight, in bad weather conditions in the drying chamber (8). Finally, the dried coal briquettes are packed and sent to the warehouse (9).

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Figure 2. Coal briquettes obtained under laboratory conditions on the basis of bioorganic compounds.

Keywords: fuel, dispersion grease, briquette, press, construction, screws, briquette strength, productivity, screws, forming tool

Introduction. Wet pressing of products are traditional method in many industries. Because in this method, products of different sexes are mixing until they become the same mass and then transferred to the pressing device. Several types of pressing machines have been used in the briquette manufacturing industry. There are various methods of wet pressing, including the auger press we offer [4,5].

Screw presses are widely used as presses in construction, food, chemical, agricultural and other industries. The design structure of auger presses is simple, has a continuous operating system and differs from other presses by the ease of the control system. The main working part of auger presses is the auger shaft. There are cylindrical and conical types of auger shafts. In our research work, a laboratory stand of a cylindrical auger roller press was created, experiments were conducted and positive results were obtained. At the same time, the external force on the briquette was increased from 3 kg to 8 kg by adjusting the number of steps of the auger shaft.

The maximum allowable diameter of the auger shaft is determined by the axial movement of the d_{disco} material:

$$d_{disco} = \frac{H}{\pi} \cdot \operatorname{tg}\varphi \qquad (1)$$

Where ph is the angle of friction; ph = arctgf; f is the coefficient of friction of the material on the screw surface of the auger.

In practice, it is obtained as follows.

$$d=(0,5 \div 0,4) \cdot d_{specific}$$

The angles of the screw vary from α_D to 90 ° along the axis of the auger. The rising angles of the outer α_D and inner α_d screw lines are found by the following formulas (shown in Figure 1).

$$\alpha_D = arctg\frac{H}{\pi \cdot D};$$
$$\alpha_D = arctg\frac{H}{\pi \cdot d}, \qquad (2)$$

Practical calculation - for books it is sufficient to obtain the arithmetic mean of the angular heights.

$$\alpha_{average} = 0,5(\alpha_D + \alpha_d) \qquad (3)$$

These values are for wet and viscous materials. Due to the low moisture content and high friction of coal powder, these values should be obtained by 5 ÷ 10% more when briquetting.

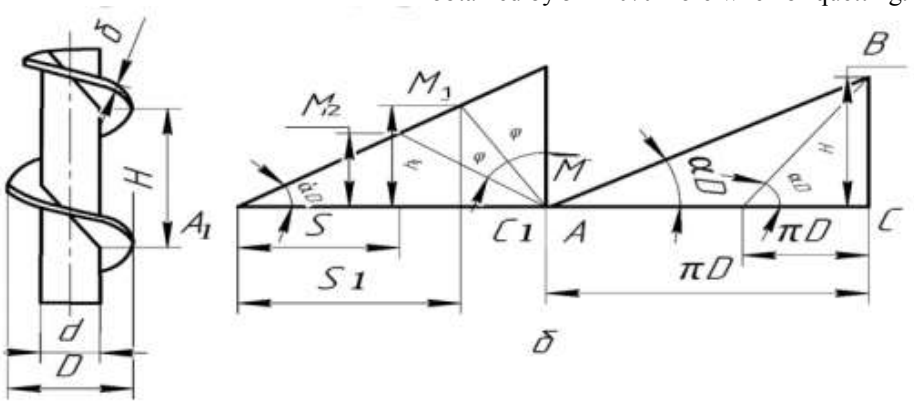

Figure 3. Scheme for determining auger performance.

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a) constructive indicators;

b) the length of the spreader (screwdriver) in one step of the screw line.

It is clear from the performance of the auger device for briquetting that in order to increase the speed and productivity of the material, the angle of the rotating lines should be brought to α = 10 ... 30 degrees, but the rise angle should not be less than 10 degrees. The area of the inner cylindrical surface of the F_B auger device housing and the area of the screw auger surface in one step of the auger can F_{sh} determined using the following formula.

$$F_B = \pi \cdot D \cdot (H-\delta) \quad (4)$$

$$F_{SH} = \frac{1}{4\cdot\pi}\left(\pi \cdot D \cdot L - \pi \cdot d \cdot l + H^2 \cdot ln\frac{D+2\cdot L}{d+2\cdot l}\right) \quad (5)$$

If $F_v > F_{sh}$, the auger is considered to have performed the pressing operation. The length of the distribution of the rotating lines corresponding to the diameters of the auger and shaft (Fig. 1) is found as follows.

$$L = \sqrt{H^2 + (\pi \cdot D)^2}\ ; \quad (6)$$

$$l = \sqrt{H^2 + (\pi \cdot d)^2}\ . \quad (7)$$

The gap between the outer diameter of the screw and the inner diameter of the housing is 0.3 ... 0.5 mm [6]. Changes in the inner diameter of the housing and the outer diameter of the auger significantly reduce the efficiency of the product. For auger press, the limit value of this gap at any point along the length of the screw shall not exceed 0.9 mm.

CONCLUSIONS

Coal briquettes based on bioorganic binders were produced according to the developed composition. Coal briquettes obtained by the developed technology have high mechanical strength, as well as high combustion efficiency and long shelf life.

Based on the research, a technological system for the production of coal briquettes based on a mixture of biocompatible components was developed.

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