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NEW TECHNOLOGY AND THE EQUIPMENT FOR BROWN COALS, PEAT AND SLIMES BRIQUETTING

Household and municipal needs in Ukraine require more than 20 million tons of coal. Annual it is mined about 80 million tons of the coal. This hardly satisfies actual needs for electric power industry and metallurgy of the country. At the same time, it has collected more than 120 million tons coal slimes near mines and preparation plants. These slimes represent a secondary fuel resource which can be used for improvement the fuel and energy balance of the country.

However, the usage of this resource can be realized for the layering burning only at an effective slimes briquetting and pelletizing.

Brown coal is another significant resource reserve in Ukraine. There is discovered more than 5 million tonsons of balanced reserves of brown coal. They can be extracted by open cast mining. This method is more economical than underground mining. The increase of output can be carried out in short period and with small capital expenses. Usage of brown coal can be conducted on special power stations. Unfortunately such stations are not used in Ukraine. Briquettes preparing for household and municipal sectors by traditional technology are unprofitable.

Known technologies of briquetting use petrobituminous bindings. That's why they are expensive and power-intensive.

The new technology of the pelletizing and briquetting of secondary fuel resources and brown coal has been developed at National Mining University (Dnipropetrovsk, Ukraine). It is based on adhesion-chemical proceeding in viscously plastic systems and forming thin dispersed particles of coal.

The essence of adhesion-chemical pelletizing is in follow. The hashing and grinding of coal and clay particles causes the knitting properties on their surfaces. It is established, that the Eh-potential in such situation increases in 2–2,5 times.

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Authors developed the methods of influence on the dispersed particles, that raising the Eh-potential. For example anthracite slimes from the Donetsk store changed this from *Eh* = 15,8 mB to *Eh* = 32,5 mB. It is established, that increase Eh-potential causes the rise in durability of briquettes in 4–5 times. Dependences of durability of pelletizing samples from Eh-potential are presented on Figure 1.

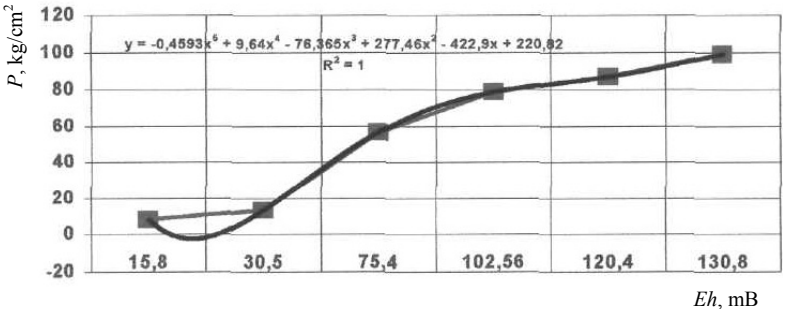

Fig. 1. Dependences of durability of pelletizing samples from Eh-potential

The received strength *P* with the sufficient high degree of convergence can be described by the composite polynomial function of the fifth order from quantity Eh-potential of the parties. It enables to predict the strength of the final product.

The petrographic composition of slimes in Ukraine is rather manifold. Therefore, the passport of an initial material for briquetting was developed. It includes the all-round analysis of qualitative and quantitative characteristics of coal and rock component in pelletizing products. As an example we give the analysis of several types of the waste products intended for composition coal combustible (Tab. 1).

Comprehensive research of an initial material has allowed developing the universal technology of the adhesion-chemical pelletizing brown coal and carboniferous wastes. We make the differentiated approach to the concrete material and composition with the purpose of reception of an end-product with necessary strengthening and calorific characteristics.

Taking into account these properties, it is possible to make the composition fuel with the mixture of carboniferous and anthracite slimes, brown coal, different genus waste products containing organic substances, rasping, the crushed paper, and knitting substances for the heightened durability of briquettes.

Palletizing fuel has high heat power and mechanical properties. Also it has the sufficient mechanical strength, water resistance and thermostability. The stratum of such combustible has good gas permeability at burning. That ensures enough complete degree of combustion.

We developed two modifications of installations for production of composition coal fuel (HOT-3 and HOT-31). They present the technological line designed by three succession fixed worms (Fig. 2). In each step there is pressing of the deteriorated in storage carboniferous swaft, brown coal and other ingredients, including additional components. The charge processed by such method is pressed through special filters with circular holes. From the step to the step it acquires the increasing toughness and the homogeneity.

TABLE 1

Characteristics of an initial material for briquetting — Coal slimes and dust coals

Type of coal (slime/ dust coal)	Granule metric structure	The content of particles, %		The form of particles		Physicomechanical properties
		clays	coal	clays	coal	
A (slime)	–10,0 + 2,5	–	–	Lamellar, close to the sphere form	Many-sided, complex	Viscous, rather damp (17,2% humidity), not waterproof, has the strongly pronounced brightness, is well formed
	–2,5 + 1,0	–	–			
	–1,0 + 0,315	–	–			
	–0,315+ 0,05	14,13	28,43			
	–0,05	19,07	38,37	Close to the sphere form		
	Total	100				
T (dust coal)	–10,0 + 2,5	4,59	11,62	Many-sided, complex	Many-sided, complex	Friable, close to dry (8,0% humidity), waterproof, has the expressed black color, is well formed
	–2,5 + 1,0	6,52	16,52			
	–1,0 + 0,315	7,71	19,52			
	–0,315+ 0,05	7,86	19,91		Needle-shaped (about 10%), close to sphere form	
	–0,05	1,63	4,13		Close to the sphere form	
	Total	100				
G (slime)	–10,0 + 2,5	0,68	3,18	Close to cubic	Many-sided, cubic	Closer to friable, rather damp (17,0% humidity), waterproof, has the strongly pronounced nuance grey, is formed insufficiently well
	–2,5 + 1,0	2,22	10,45		Cubic, parallelepiped	
	–1,0 + 0,315	8,90	41,95			
	–0,315+ 0,05	4,28	20,16	Lamellar, close to the sphere form		
	–0,05	1,43	6,75		Close to the sphere form	
	Total	100				

a)

b)

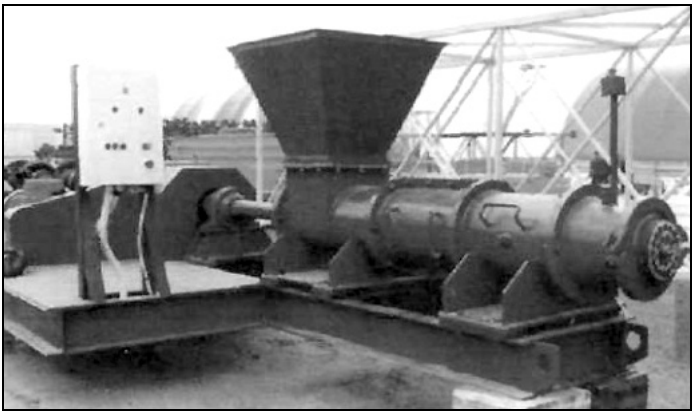

Fig. 2. Common view of installations HOT-3 (a) and HOT-31 (b)

The final product (Fig. 3) leaves as cylindrical cores of various diameters (depending on the sizes of filters) from 10 up to 30 mm.

New fuel has heating ability not less than 3500 kcal/kg, at briquetting brown coal — up to 4500 kcal/kg, and anthracite slimes — up to 6500 kcal/kg.

The fuel has sufficient durability and not sticking together with each other. It is transported to the warehouse where they become harden and dry. Drying is carried out due to natural ventilation or at submission of hot air. The process of drying is conducted from several hours to some days. The briquetting technology has low power consumption — up to 10 KW-h/t. The cost price of product is 25–30 UAN/t.

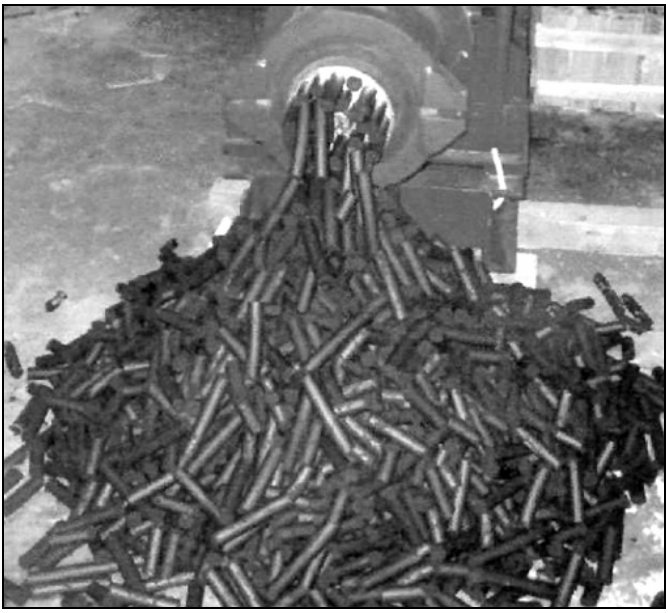

Fig. 3. Fragment of an output of final product

Characteristics of installations HOT-3 and HOT-31 is presented in Table 2.

TABLE 2
Characteristics of installations HOT-3 and HOT-31

The type of installation	HOT-3	HOT-31
Productivity, t/h	1,0–1,2	5,0–5,4
Dimensions, mm — height — length — width	 3050 3350 1600	 1500 4600 2000
Quantity of steps	3	3/1
Diameter of the worm, mm	200	350
Power of the electric engine, KW	15	45
Weight, kg	2100	3400

The system (Fig. 4) provides preparation of initial raw material, submission of raw material for press, actually pressing-briquetting, drying of final product, transporting it to the warehouse.

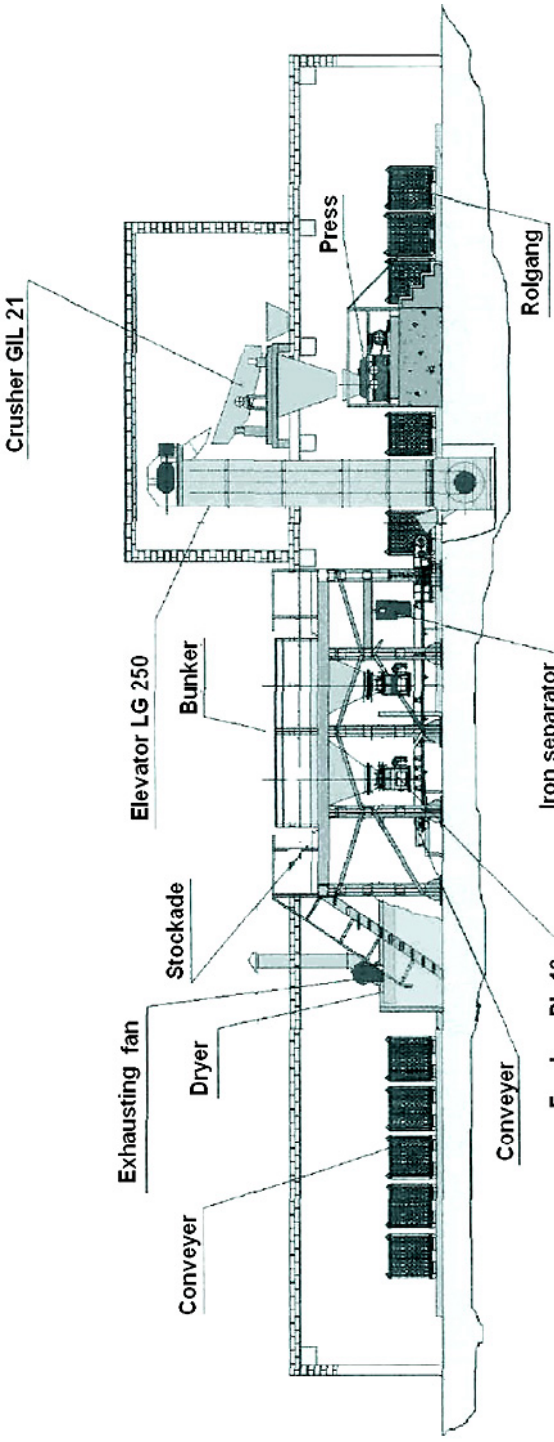

Fig. 4. The technological scheme for briquetting with installation HOT-31 (Arrangement solution)

Proceeding of technological scheme. Initial material (brown coal, peat, slime, etc.) are loaded by the truck loader into bunkers. The material is transported by belt conveyers. With the help iron separator it has been extracted from ferromagnetic subjects. In crusher, the initial material is separated to fractions 0–20 mm. Than material is transported to the bunker of installation HOT-31. From installation the final goods are unloaded in the mesh container. Containers are delivering to the drying chamber. The drying chamber is pumped hot air. After the drying chamber containers are transported to warehouse. Here there is an accumulation and final drying of products.

To potential customers are offered separate installations which can be used in existing technological lines, and the technological system equipped by installation HOT-31 (Fig. 4) Productivity of the system is 35,0–40,0 t/hour.

Conclusion

The offered technology is the cheap method of reception of secondary technogene fuel. At increase in the price of gas, it is the important element in maintenance of fuel balance of the country. This experience is useful to other coal-mining countries which have saved the huge volumes of coal slimes. Production of composite combustible has the important ecological value, because it is used waste products of other industries.