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FEATURES OF BIOMASS GRANULATION

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In recent years, solid fuel based on renewable energy sources has become widespread in Ukraine and the world [1-2]. Biomass pellets are among the most popular according to demand. Today, according to international studies, about 7 % of the world's biomass is needed to replace fossil energy sources. Popular sources of biomass are sawdust, grain waste, straw and seed husks, sunflower waste, reeds [3].

Sawdust is formed as a result of wood processing. Sawmills and furniture factories regularly generate such waste. It is an excellent biofuel with high calorific value and low cost. Pellets obtained from sawdust can be used in home pyrolysis and even industrial boilers.

The basis for the pellets is coniferous or oak sawdust, only they contain a sufficient amount of lignin (natural glue). They can also be used neat. Species of other sawdust are granulated only if the recipe contains ≥ 60 % oak or pine needles. For granulation of roots, thin branches, hornbeam, ash, acacia, 10–20 % of soybean, rapeseed or sunflower waste is added to sawdust as a binder. If you need to process a lot of sawdust, it is better to choose an automated fuel pellet granulation line.

Cheap fuel is raw material from wood fiber board scraps (MDF, HDF, OSB). Compared to wood pellets, the ash content of this biomass is slightly higher. But on the other hand, the granulation of residues allows you to get rid of garbage at the enterprise and reduce the cost of heating the premises. Such materials already contain natural glue, so you do not need to add oak / pine sawdust to them. But special equipment is required. Hulls, weed seeds, particles of leaves and stems, damaged and too small grains that are formed during the primary processing of cereals (drying, cleaning and sorting) are grain waste.

Grain wastes of wheat, rye, oats and other food crops have a high nutritional value, therefore they are used for the production of pelleted feed. Grain waste of industrial crops (rapeseed, soybeans) has a high calorific value (19 MJ / kg or 4600 kcal / kg) and low ash content (8 %), they are used as a cheap fuel.

Table 1. Granulators for biomass processing

Raw materials	Engine power, kW	Productivity, kg / hour
Sawdust	15–22	100–250
Grain waste	2,2–22	80–500
Seed straw and husk	11	100
	22	250–300
Sunflower waste	7,5	150–250
	11	200–300
	22	400–500

Straw pellets are used as fuel, although compared to granular sawdust, their calorific value is slightly lower. Straw in pellets has 10 times higher calorific value than in original form, and husk has a higher calorific value than sawdust [4].

In order for pellets from straw and sunflower seed husks to be dense and smooth, it is necessary to add 10–15 % of soybean, rapeseed, sunflower waste (stems, heartwood, ragweed) to the raw materials.

Straw forage pellets are not made; hay is better suited for this (mown and dried stems and leaves of herbaceous plants). According to the recipe for the feed mixture, cereals, vitamins, premixes are added to the crushed hay, and all components are combined in a mixer [5].

Sunflower waste (stems, fibrous core, ragweed) is perfectly processed into fuel pellets. If earlier they were simply burned in the fields, now they are used for heating their own production or even sold.

Fuel pellets made from pure sunflower waste contain fat, therefore they are not suitable for all boilers [6]. It is best to use such residues as an additive to sawdust or straw, which are difficult to granulate.

Nowadays, the reed is mainly used for feeding horses and cattle, it can also be used for weaving furniture and baskets, covering the roof, etc. However, the most advantageous is the use of this grain for the manufacture of fuel pellets and / or briquettes [7].

The reed contains a fairly high silicon content. Silicon gives this plant resistance to attack by bacteria and insects, provides water repellency and, at the same time, makes it highly flammable. But the silicon content in the reeds also has a negative side: silicon creates certain difficulties when grinding and pressing this material, as well as when burning reeds, which is present in the very technology of producing granules and briquettes from it. Thus, the use of reeds as a raw material for the production of fuel pellets opens up great prospects. If the reeds are prepared in the form of green mass (before drying), then valuable granular feed can be produced from it. Since there are no costs for growing reeds, only collection (harvesting) and processing costs are needed to produce both biofuels and pelleted feed.

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USE OF NANOTECHNOLOGIES IN POULTRY

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In organizing the effective marketing of poultry products, their safety and high quality play an important role. The urgency of this problem is due to the increased attention of the population to a healthy lifestyle. Only clean food products of the industry, high quality and environmental friendliness of which are confirmed by international standards, can attract the consumer and provide the enterprise with profit, which has become a prerequisite for successful and effective entrepreneurship. It is high-quality products, especially enriched with nutrients and microelements, that are now becoming the defining criterion for the competitiveness of a poultry enterprise. The presence of a certificate is a kind of pass to the poultry products market, as well as a guarantee of the good quality and safety of the finished product for the buyer [1, 2]. The most reasonable way to improve the provision of the population with deficient nutrients is