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ENVIRONMENTAL ASPECTS OF THE PRODUCTION AND USE OF PELLETS FROM BIOMASS

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Global climatic changes, including an increase in the Earth's surface temperature are caused by the emission of greenhouse gases into the atmosphere, the main source of which is energy. In this regard, at present, much attention is paid to renewable energy sources around the world. Bioenergy based on the production of energy from biomass (oilseeds, straw, wood, manure, organic waste, etc.) is one of the more perspective energy source for the nearest future in Europe [1]. One of the directions of bioenergy for the transport is the production of biodiesel from rapeseed. Engines of a special design can work on rapeseed oil, and conventional diesel engines adapted to such fuel can work on mixtures with diesel fuel of petroleum origin. The development of biofuel technologies will reduce the dependence of the economies of the EU countries on oil imports.

For the heating energy the main alternative to fossil fuels which used for the production of thermal energy (coal, firewood, peat, gas, fuel oil) is pellets from biomass.

Pellets are made from wood processing industry waste (sawdust, shavings, wood chips, substandard products), and agricultural production (sunflower husk, buckwheat, rice, straw of various crops, etc.). Pellets have a cylindrical shape and small size, which allows to automate the heating process. For this type of fuel, special thermal boilers are used, in which pellets are automatically fed from the storage hopper.

In the EU countries, pellets are widely used for heating industrial and domestic premises, due to the possibility of automation of the process, as well as environmental and economic advantages of fuel. Pellets are most actively used in the Scandinavian countries (Sweden, Austria and Denmark), which are also European leaders in the production of equipment that is used for the manufacture and burning of pellets.

Standards for pellet sizes may vary in depends of country. Generally, pellets can be from 5 to 10 mm in diameter and 6 to 75 mm long. Not only dimensions are standardized, but also the ash content of the product. These standards also have a certain range of parameters. So, for example, in the USA, high-class pellets should have an

ash content of no more than 1 %, in most European countries - no more than 1.5 %. [2]. The class "standard" is limited to an ash content of 3 %. A larger indicator is not allowed and is not used: it is unrealistic to conclude a contract for the supply of pellets with an ash content above 3 % in Europe.

Pellet production takes place in several stages:

1. At first, the incoming raw materials go through the first stage of grinding, breaking into fragments 25 * 25 * 2mm. This step is necessary for more uniform and faster drying. Raw materials are supplied to the crusher with a scraper; it must be stored on concrete flooring to prevent the ingress of soil, sand and stones.

2. The semi-finished product in belt or drum type dryers is brought to a moisture content of 8-12 %.

3. The resulting mass is finely crushed (particles no more than 4 mm, for high-quality granules 1.5 mm) using hammer mills.

4. If during the drying process the moisture content of the raw material drops below 10 %, the semi-finished product is moistened with finely dispersed water or steam. Steam is needed for hardwood (oak, etc.) or for stale raw materials. There is enough water for softwood or quality raw materials. At this stage, screw mixers are commonly used.

5. The resulting product is pressed. The press may have a flat or cylindrical matrix. The size of the matrix determines the performance of the installation. The amount of raw materials produced per unit time also depends on the diameter of the granules.

6. The pellets heated during pressing are cooled. During cooling, their humidity decreases, which improves the quality.

7. The granules are sieved and packaged. In order to maintain the quality of the pellets unchanged, pack the products in large bags - big bags, which are delivered to the consumer. The highest quality products are packed in 20-25 kg bags.

During the burning 1 ton of wood pellet, the same amount of energy is released as when burning 1.6 tons of wood, 480 m^3 of gas, 500 liters of diesel fuel or 600 liters of fuel oil. The calorific value of wood pellets is comparable to coal and amounts to 4300 – 4500 kcal / kg. The combustion products of coal significantly affect air pollution. The sulfur content in coal slag is more than 30 times than in briquette ash, and slag is formed (requiring disposal) 20 times more. Diesel fuel and fuel oil contain almost all the elements of the periodic table. When burned, a huge amount of substances harmful to the human body, including carcinogens, is released.

Table 1 – Calorific value of fuel [3]

Type of fuel	Calorific value, MJ / kg
wood (wet)	10
wood (dry)	12
brown coal	16
wood waste pellets	18
black coal	20
natural gas	32

Table 2 – Emissions of pollutants into the atmosphere when burning various types of fuel [4]

Type of fuel	Pollutant emissions in atm. air without purification systems, tons per 1 thousand tons of Nat. fuel				
	CO	NO_2	SO_2	particles	Total Emissions
Natural gas	1,18	3,52	0,00	0,00	4,70
Wood briquettes, pellets	4,68	9,31	0,28	4,11	17,69
Wood	4,9	9,4	0,3	4,3	18,9
Sawdust	5,0	9,6	0,5	5,0	20,0
Wood waste, trimming	5,2	9,9	0,4	5,2	20,7
Fast growing wood	4,8	9,5	0,0	8,4	22,7
Chips, bough, bark	5,6	11,4	0,8	13,4	31,3
Fuel oil	5,20	5,20	35,30	0,30	45,90
Peat briquette	8,04	26,81	3,00	13,02	50,87
Coal	9,58	63,56	9,20	65,32	147,66

Table 1 shows a comparative characteristic of the calorific value of the briquette in comparison with other types of fuel.

The levels of pollutant emissions into the atmosphere during the combustion of various energy carriers are given in table 2.

From the table it follows that wood fuel (primarily pellets and briquettes) is more preferable, in terms of air pollution, compared to fuel oil (especially coal). Wood fuel also has virtually no effect on greenhouse gas emissions, especially CO_2.

The use of wood fuel as an energy carrier is fully consistent with the provisions of the Kyoto Protocol regarding the limitation and reduction of greenhouse gas emissions. Pellets are part of the natural CO_2 cycle in the environment and environmentally friendly fuels, unlike coal, etc. In addition, pellets are renewable fuels, unlike coal, oil and gas.

Pellets during burning do not emit a smell, and, as a rule, due to the high efficiency of boiler equipment, the smoke from pellets is practically colorless. Due to the low sulfur content in the pellets, sulfur dioxide emissions into the atmosphere are reduced, which, in turn, leads to a decrease in the amount of acid rain.

When burning pellets, the specific emission of a number of harmful compounds is reduced compared to coal and liquid fuel (fuel oil).

References

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