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DEFINING CHARACTERISTICS OF COMBUSTIBLE STRAW PROCESSES AND ANALYSIS OF ITS BURNING AND GASIFICATION

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Straw is a promising alternative fuel in Ukraine. Its potential in Ukraine is estimated to 4 thousand. Tons of conventional fuel up to 4000 tons of equal fuel. But its use is somewhat limited because of organizational and technical reasons. Straw as fuel has several significant shortcomings solution of which requires detailed analysis of its physical and chemical characteristics and combustion or gasification of straw.

In addition to basic combustible elements (C and H) in the straw also contains chlorine and ash complicating the process of burning and clearing of waste products. If straw is not pre-processed into briquettes or Pellets, it absorbs a significant amount of atmospheric moisture which reduces its heat of combustion and complicates the process of combustion and gasification.

In addition to biomass combustion, its gasification is better, in most cases, because of the low melting point of ash and nitrogen content in the composition of biomass is more appropriate for biomass and straw particular. Straw gasification process occurs in several stages, first biomass is heated and dried, and then going out volatile components and partial combustion (pyrolysis) and carbon residue reacting with the products of pyrolysis generates a combustible gas.

The rate of passage of all stages of gasification essentially depends on the type of material that gasifies and process temperature. It was shown holding an experimental study of gasification of straw granules and petroleum coke. As seen in Figure 1, the dynamics of thermochemical conversion of pellets shows that moisture is lost after 10 minutes. Intense out of volatiles is between 20 and 30 min., and complete gasification of carbon – at 85 minute. Output of volatiles was 70%. As shown in Fig. 1, thermochemical conversion of petroleum coke were not the same, due to the nature of carbon in the composition of petroleum coke and no volatile components in coke.

As a result of experimental studies defined points (periods) phase transition from the drying of biomass to release volatiles mode and then - to the point of combustion and gasification of carbon residue.

In the process of combustion and gasification also significantly affects fuel moisture. Humidity biomass can varies considerably depending on climatic conditions. Increased moisture biomass primarily reduces the temperature of combustion or gasification and combustion reduces heat reducing general efficiency of energy use of biomass.

To determine the range of variation of humidity straw a pilot study was conducted to determine its moisture under different storage conditions and humidity.

Determination of moisture straw enforced by weight difference before and after drying the sample in an oven at about 105^0C. Simulation of different storage

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conditions straw and humidification in which it was, was carried to the introduction of air sprayed water followed by exposure of straw in a humidified condition 2 to 3 days.

The results showed that the absorption capacity of water vapor straw relative value limits the maximum humidity at around 77%. After reaching the specified value is reached saturation moisture and humidity straw practically not increased.

The dynamics of change in the basic characteristics of the combustion process depending on the humidity of straw. The heat of combustion of straw with the increase of moisture significantly reduced - from 15.2 MJ / kg at 10% moisture by weight. to 3.9 MJ / kg - 77% moisture by weight. Together with the decrease of the heat of combustion of straw increased costs for units of heat. For example, if humidity is 10% it costs for straw boiler capacity of 1 Gcal / hour is about 350 kg per hour. And if the maximum humidity − increase to 1350 kg per hour. That significantly increases the fuel cost component of logistics. Even with increasing humidity of 30 - 40% by weight, using straw as fuel becomes impractical.

The process of burning wet straw burning accompanied by a decrease in temperature and an increase in heat loss from the exhaust gases. Increased humidity combustion in the presence of sulphur dioxide leads to the need to maintain the output of the boiler temperature greater combustion products through property sulfur dioxide increase the dew point of the combustion products. It also increases the loss of heat from the exhaust gases.

The calculations showed that the increase in moisture biomass of 10% by weight to 77% by weight. reduces the temperature of combustion $980^{o}C$ (with $\alpha = 1,5$) to $600^{o}C$ and loss of heat from the combustion products increased from 10% to 18%. Increased moisture biomass also causes the greenhouse gas CO_2 from fossil fuel combustion, due to an increase in the volume of the combustion products through the growth of the content of water vapor. The research and calculations show the urgent need of pre-drying straw before burning it or store it in a locked warehouse