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Quality of Pellets before and after Torrefaction. Results of Experiments

One relatively new process in terms of bioenergy is torrefaction. Torrefaction is low-temperature pyrolysis, which consists of thermo-chemical conversion of biomass at temperatures of 200-320 ° C without oxygen. During heating to a temperature of 160 ° C biomass loses moisture, but its properties, including absorbing water, do not change. By further heating the biomass starts to turn brown, the acetic acid and phenol is separating out. Biomass begins to change the physical and chemical properties. It becomes more fragile and more hydrophobic. By further heating biomass is giving off gas, which consist of CH₄, H₂, C_xH_y, CO and CO₂.

To compare features of conventional pellet sand pellets after torrefaction, a series of experiments was made.

1. First of all moisture content was measured. Conditions of this experiment were: temperature in drying oven - 100 ° C, process duration - 1 hour. It was found out that the resulting humidity of pellets was 7,6%.

2. Secondly, volatile-matter content was determined. The temperature in the furnace was 850 ° C, process time was 7 minutes. Yield of volatile was 87,62%.

3. Thirdly, ash content was measured. Conditions of this experiment were close to second one, however duration of the process was 1 hour. Ash yield was 1%.

4. At the end, the content of volatile-matter during torrefaction was determined. This experiment lasted for one hour. Yield of volatile at different temperatures of the process was calculated. For 200 ° C the output of volatile was 10,15 %, for 300 ° C - 46,4%.

After these experiments and number of calculations it is possible to make conclusion that calorific value of pellets after torrefaction is 6052 kcal/kg. It is much higher than calorific value of conventional pellets which is just 4000 kcal/kg. Besides their value is near to coal fuel.

As a result of the present experiments it is possible to make conclusion that torrefaction is rather useful process which could improve energy properties of pellets. Torrefied product has lower moisture content, hydrophobic and less explosive. Higher energy content (per unit volume) makes transportation and material handling less expensive.

Unfortunately, the process of torrefaction is new for Ukraine and it is not used here. However Canada and a number of European countries use this method for biomass processing.