INFLUENCE OF GASEOUS ATMOSPHERE ON THERMAL DECOMPOSITION OF BIOFUEL

Korinchevska Tatiana Volodymyrivna, Mykhailyk V.A., Korinchuk D.M.
Institute of Engineering Thermophysics of NAS of Ukraine
tel. (044) 424-12-26, e-mail: tvkorin@gmail.com

The aim of the work is to study the effect of the composition of the gaseous atmosphere on the thermal decomposition of biofuels.

The results of the work. The study of thermal decomposition of fuel is carried out in a derivatograph Q-1000 in an open conical platinum crucible with heating from 20 to 1000 °C at a rate of 7.4 K/min. Samples in the form of tablets with a diameter of 8 mm and a height of 2.5 – 3.0 mm are made by pressing pine wood sawdust with a particle size of $0.2 < l < 3$ mm.

The quality of the atmosphere in the thermal decomposition zone is changed during the research. The first is the gas atmosphere, which is formed in a limited volume filled with still air, as a result of the removal of water and gases of thermal decomposition of organic matter of the fuel. The second is an atmosphere enriched with oxygen due to the forced supply of air (10 – 12 l/h) to the decomposition zone. The third is an inert medium formed by gaseous nitrogen, the flow of which is maintained at a level of 20 – 25 l/h.

Water removal from the samples is occurred in the range of 20–180 °C, regardless of the type and quality of the gaseous medium. An increase in the oxygen content in the reaction zone accelerates the decomposition rate from 2.17 % dry matter/min. in static gaseous medium up to 3.19 % dry matter/min. in a medium with forced supply of air, and narrows its temperature range from 181 – 518 °C to 173 – 411 °C.

In an inert medium, thermal decomposition takes place according to the scheme of wood pyrolysis in the range of 181 – 863 °C at an average speed of 1.04% of dry matter/min.

The decomposition reaches the highest rate at about 300 °C. More than half of the organic matter undergoes destructive changes in the range up to 325 °C: 50.05 % in a static gaseous medium, 58.62 % in an air flow and 53.65 % in an inert atmosphere.

Estimation of thermal effect of the reactions of thermal decomposition showed that the conditional specific thermal effect practically does not depend on whether the air is in the reaction zone in a static or dynamic state, but it is 28% less in an inert medium.

Conclusion. The gaseous atmosphere in the reaction zone significantly affects the kinetics and the course of thermal decomposition of the organic matter of wood.