Influence of drip cooling on the energy efficiency of the torrefaction process

Kortsenshteyn N M, Shevchenko A L[@] and Zaichenko V M

Joint Institute for High Temperatures of the Russian Academy of Sciences, Izhorskaya 13 Bldg 2, Moscow 125412, Russia

[@] shev@jiht.ru

Modern trends in the development of world energy are aimed at minimizing the anthropogenic impact of human activities on the natural balance. First of all, this concerns the processing of a huge amount of waste that is generated as a result of human activity. The use of biomass as a fuel does not change the natural CO_2 balance. Plants absorb carbon dioxide during the growth period, and the same amount of this gas is released during the subsequent processing of biomass and its natural loss (decay). As a result of low-temperature pyrolysis (torrefaction), qualified solid biofuel is obtained from biomass, which has an increased calorific value and hydrophobicity. Torrefied biofuels can serve as a CO_2–neutral substitute for fossil coal. A pilot plant has been created at the JIHT RAS, which implements a quasi-continuous process of energy-efficient torrefaction of granular biomass. The technology is based on the use of a gas piston power unit as a heat carrier and the internal energy of exothermic reactions. In this paper, we consider the possibility of further improving the energy efficiency of the torrefaction process due to fine-dispersed water injection into the cooling section. The presented results of numerical simulations show that drop water cooling can significantly reduce the consumption of cooling gas required to achieve a safe temperature of the pellets before unloading into the atmosphere, and reduce the total energy consumption by about 30%.