SUMMARY

Waste production is an integral part of processing plant and animal raw materials, and the quantity and type of waste vary depending on the agri-food industry (AFI). The largest waste stream in Poland is generated by the fruit and vegetable industry, which processes about 60% of fruit and up to 30% of vegetables. Wastes from agri-food processing (such as: pomace, spent grain, and waste from processing carrots and other vegetables) are characterized by high calorific value, however, a significant barrier to their energy use is the need to drain excess water during the drying process. The drying methods currently used are energy-intensive, so new technologies are continuously being sought. An alternative solution for preparing biodegradable waste for energy use is biodrying. Although the engineering of this process is known, it has been optimized over years.

This paper presents research on the impact of the conditions of the biodrying process of high-moisture agri-food industry waste on the conduct of the process and selected energy properties of the produced fuel. The research material consisted of vegetable processing waste and fruit pomace, while the bulking agents were refuse-derived fuels (RDF) and undersized fraction from municipal solid waste (UFMSW). Twelve test series were conducted, including 4 control series and 8 mixtures of AFI waste with bulking agents in the proportions of 50:50 and 30:70. Each series was carried out at 3 different air-flow rates and the biodrying process lasted for 14 days. The analysis of physicochemical and energy parameters of the waste and their mixtures was performed before, during, and after the biodrying. During the biodrying process, the temperature of the feedstock and the concentrations of O_2 and CO_2 in the exhaust gases were monitored.

Analysis of the results from this study concluded that the addition of different bulking agents has a significant effect on the energy properties of the waste, including moisture content, ignition loss, ash content, carbon content, heat of combustion, and calorific value. The carbon content and calorific value of the obtained fuel are also influenced by the ratio of bulking agent to AFI waste. Additionally, the air-flow rate significantly affects the energy properties of the fuel obtained after the process, particularly total moisture content and calorific value. The use of RDF as a bulking agent allowed for greater moisture reduction while maintaining a higher carbon content, resulting in a higher net calorific value.

Keywords: biodrying, bulking agent, AFI waste, calorific value