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Abstract

Optimization of the Composition of Biomass and Waste Biomass Blends for Combustion in a Small-Scale Power Boiler

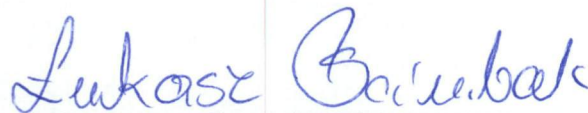
This doctoral dissertation addresses the topic of energy transformation in the agri-food industry by replacing fossil fuels with plant-based energy biomass. The main issues discussed in the thesis include the optimization of biomass mixture composition, the method of its mixing and feeding into the biomass boiler hopper, with consideration for the necessity of maintaining stable thermodynamic parameters of the produced steam, which is essential for technological processes in the agri-food industry.

The agri-food sector, characterized by a high demand for heat and power generates significant amounts of organic waste that can be used as a raw material for renewable energy generation. The thesis evaluates the efficiency and feasibility of co-combustion of various types of biomass, which are by-products or waste from the agri-food and agricultural industries. The analysis also includes an assessment of the availability and quality of biomass, its physicochemical composition, the efficiency of the combustion process, and its impact on the reliability of industrial installations. The conducted research aims to verify hypotheses regarding the environmental, technological, and business benefits of implementing renewable energy sources in the agri-food sector.

The case study of the Polmos Żyrardów Sp. z o. o. plant provides a practical context for the research, with a particular emphasis on ensuring stable operating parameters of the steam systems and the rational management of by-products from production processes. The dissertation presents the possibilities of managing combustion products, such as ash, in the agricultural production area, thereby closing the biomass cycle in nature, which is in line with the principles of a circular economy and sustainable development.

The work aims to demonstrate the potential of using biomass as an alternative, low-emission energy source, allowing for a reduction in CO₂ emissions and an increase in energy independence and competitive advantage for companies in the agri-food industry.

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Data i podpis doktoranta