

mgr inż. Błażej Gaze

Department of Low-Emission Energy Sources and Waste Management

Wrocław University of Environmental and Life Sciences

PhD thesis title: **Reduction of pollution resulting from the energy conversion of agricultural waste**

## **The summary**

Due to the deteriorating condition of the environment and trends in the use of bio-waste, research was carried out on the influence of catalysts on the amount of harmful substances emissions after the incineration of agricultural waste. Two agricultural waste, widely available in Lower Silesia, i.e. wheat straw was used in the research and waste from the cultivation and processing of hemp. The third (reference) fuel was the Olimp wood pellet, which is the most popular energy carrier from biomass fuels.

All fuels were subjected to technical and chemical analysis in terms of their energy use. Four catalysts were prepared on the surface of the EG-PELET boiler deflector. The active phase of the prepared catalysts was: Pt, TiO<sub>2</sub>, CuO, and MnO<sub>2</sub>. To select the conditions and methods of catalyst preparation, the temperature distribution in the combustion chamber and under the deflector surface was determined with the use of mathematical modeling methods and ad hoc tests on an operating boiler.

In all measurement cycles, the temperature in the combustion chamber, fuel consumption, emissions of CO, NO<sub>x</sub>, PM, VOC, and PAH were recorded. The technical and chemical properties of the resulting ash were determined in terms of their use as a fertilizer.

The collected results allowed to determine the real impact of the use of catalysts on the aspect of boiler installation efficiency, where its average increase was recorded in the range of 0.88-4.38% depending on the catalyst concentration and the type of fuel used. Thanks to the obtained results, the influence of the use of catalysts on the environmental aspect was characterized. An example may be the reduction of NO<sub>x</sub> emissions generated during the combustion of selected biomass fuels in the range of 42-64% (using a platinum catalyst with a concentration of 1.2 g/m<sup>2</sup>). The economic effect of using catalysts was determined, which can reach up to 2,572 PLN savings (by burning wood pellets) with the use of a platinum catalyst in the third concentration (1.2 g/m<sup>2</sup>). The result of the work is a ready-made original solution that can be implemented into mass production.