Abstract for general public of the *FoodWastValor* project

Climate change and increased greenhouse gas emissions are globally recognised. Due to the challenges of obtaining energy from other sources than fossil fuels, the European Union (EU) is introducing multiple regulations for the use of Renewable Energy Sources (RES). Furthermore, due to the current global political situation, the EU is also putting a high priority on the obtaining of raw materials and, above all, the recovery of valuable materials from waste.

The utilisation of waste is in line with the waste hierarchy described in Directive 2008/98/EC, as well as with the idea of Circular Economy (CE). According to the CE concept, the process waste should be used to generate a new product. Therefore, the waste could be subjected to thermochemical processes, like gasification, to obtain a valuable gaseous product, i.e. syngas, which can be used in the energy sector or as a feedstock in the chemical industry. Meanwhile, solid residue from the gasification process can be valorised for use as activated carbon or adsorption material for the capture of CO_2 or organic pollutants, as well as a catalyst in further thermochemical processes.

The main objective of the *FoodWastValor* project is to study the gasification of food industry waste (i.e. hop cones, cherry seeds, rapeseed cake, beet pulp) in a cascade system in presence of a catalyst to produce high quality gas and value-added solid material. Fundamental research of the catalytic gasification process will be carried out in an atmosphere of CO_2 and steam mixture, to obtain a gaseous product with a high hydrogen content, as well as a solid residue with a highly developed porous structure. The solid residue after the gasification process (*char*) will be valorised in order to improve its physical and chemical properties, i.e. specific surface area, porosity, catalytic properties, adsorption properties and CO_2 capture capacity. Experimental studies of the char valorisation process will focus on the development of efficient and effective methods to obtain new materials with a wide range of applications (from material to environmental). Advanced research techniques will be implemented to investigate materials in line with the most recent global scientific trends.

Development of the chemical reactions model, during the catalytic gasification process, via thermodynamic and numerical calculations using Aspen Plus is a significant part of the project. New model will describe the gasification of food industry wastes with emphasis on effects of temperature, steam to feedstock ratio and the presence of a catalyst. This result is an important and innovative outcome of the project.

The comprehensive research planned within the project will allow the extension of the knowledge related to the treatment of waste by catalytic gasification, the production of high-hydrogen syngas, the valorisation of the materials and the application of the obtained materials for soil contaminants and CO_2 capture, as well as the preparation of catalysts. Research results will contribute to the development of new materials obtained from food industry waste.

The *FoodWastValor* project will be delivered at the AGH University of Krakow by a team of scientists whose have the knowledge in the field of thermochemical waste processing, investigation of adsorption properties of materials and conducting experimental and numerical research, as well as they have the experience in the realisation of research projects. The project results will be published in scientific journals and presented at national and international conferences to promote the environmental benefits of waste management in line with a circular economy concept.