DESCRIPTION FOR THE GENERAL PUBLIC

Nowadays, plastics are materials that are used in almost every branch of industry. Their popularity is due to their excellent mechanical properties linked to low weight. However, the increase in their production amount results in the increase of waste that needs to be managed. Unfortunately, still, the widespread practice of handling plastic waste is landfilling. The amount of plastics that can be sustainably recycled has increased in the last decades due to improved identification and sorting technology. In 2020 75% of plastics in Europe are recovered by recycling or incineration, which is still the most often used technique to manage plastic waste because of the complexity and cost for other recovery ways. This makes it necessary to manage waste and therefore many scientists carry out research on various recycling methods. Plastic recycling is divided into three basic areas: mechanical recycling, chemical recycling and energy recovery. Chemical and feedstock recycling of plastics is an option for waste management which allows for the reducing the amount of the waste in landfills and obtaining valuable chemicals or monomers which can be further used that contributes to saving the natural resources. New methods and rection parameters are developed by researchers to reduce the environmental impact of plastic waste and to find new, more efficient ways to decompose these materials.

The objective of this project is to evaluate the usage of the metal-organic frameworks (MOFs) as the catalysts for the chemical recycling of the following polymers PET, polyurethane (PU) and polycarbonate (PC). In the last two decades, MOFs became a popular topic among researchers due to the possibility of control of pore structure, their adsorption properties, and the nature of active sites and found application various catalytic biomass reactions (i.e. hydrolysis, oxidation, esterification, condensation polymerisation and more). In this project, the new application area for MOFs is proposed. In the scope of this project, the synthesis of MOFs will be performed and then prepared MOFs will be used as the catalysts for the reactions of the chemical recycling of plastics. It will be determined how the usage of MOF catalyst influences the reaction mechanism, kinetics of the reaction, product yield and the semi-products (remonomers or reoligomers) quality. Moreover, there will be a proposed method for catalyst removal after the completion of the chemical recycling process and its reuse for the same process.

It is expected that the thermal degradation of polymers should result in the high conversion of polymer and high yield of remonomers and reoligomers due to MOF catalysts catalytic properties such as large specific surface area and a vast number of catalytic active sides. It is supposed that obtained semi-products will be similar chemically to commercial monomers what in the future create a possibility of incorporating these intermediates in polymers synthesis or other materials.

The project will not only provide detailed scientific information but also is considered as pro-ecological due to the management of plastic waste which can be converted into valuable intermediates useful for the replacement of petrochemical raw materials simultaneously saving natural resources as monomers are conventionally made from gas and oil. Besides, less emission of harmful substances into the environment, that are formed during landfill of plastic waste, will contribute to reducing the pollution of groundwater, air and. Also, the new application for MOFs will be established as the potential catalysts for the chemical recycling of polymers.