Oxidative liquefaction of plastic waste. Experimental research with multidimensional data analysis using chemometric methods.

Synthetic polymers are very useful and comfortable materials with a number of positive properties, however, they are burdened with harmful influence on the natural environment. Plastics are inexpensive, light and durable materials that can be easily formed into a wide variety of useful products and have become indispensable in modern life and the global economy, but in recent years their consumption has grown rapidly around the world. It is estimated that about 400 million tons of different types of plastic are produced worldwide each year, becoming one of the biggest environmental problems in the world. Plastic waste is generated annually in huge amounts, slow or ineffective thermal degradation of which pollutes drinking water, poisons aquatic animals and even causes health problems for humans. The most important groups of plastic waste include: waste related to the COVID-19 pandemic, waste from wind turbines, photovoltaic panels and general household waste. Millions of discarded disposable plastics (masks, gloves, aprons, and disinfectant bottles) have been added to the terrestrial environment and can cause a surge in plastics, washing off ocean shores and littering the seabed. Thus, a critical point in a waste management strategy is to reduce the amount of this waste on an ad hoc basis while developing a sustainable strategy to transform plastic waste in the future. Thermal methods of converting plastic waste in the context of the upcoming climate decisions seem ineffective, generating harmful emissions of micro-plastics, toxins and greenhouse gases, so there is a need to develop new methods for their disposal.

The project will include studies on the oxidative liquefaction of plastic waste, including COVID-19 waste, and general samples of major groups of plastic waste. The project includes experimental studies on the liquefaction of various samples of plastic waste in subcritical water, enriched with oxidizing additives that improve the quality of the final product. The key to hydrothermal liquefaction processes is water under high pressure and temperature (200-300 ° C, 150-200 bar), which acquires the properties of a strong solvent that is able to dissolve plastics into simpler hydrocarbons, desired in the production of alternative fuels. Oxidizing additives will convert plastics to volatile fatty acids, expanding the range of plastic conversion products available. In parallel, multidimensional data analysis will be implemented using chemometric methods to identify products with high volatile fatty acid and lower hydrocarbon expectations, suitable for production from liquid waste, *i.e.* renewable, fuels and chemicals.