Nowadays, it is difficult to imagine life without hydrocarbon fuels. The possibility of mobility and energy security are crucial for both the economy and ordinary people. The production of fuels and their use bring many problems, particularly in terms of environmental protection. Concepts such as carbon neutrality and the circular economy are no longer just pipe dreams, but a real need. An important problems that the current refining and petrochemical industry must solve are the effective removal of contamination of petrochemical products, especially liquid fuels, which are an important source of air pollution. Alternative fuels, including biodiesel obtained from used cooking oil, must also meet high quality parameters. Numerous solutions have been proposed both for the purification of liquid fuels, but so far these methods have not been effective enough in their operation or require complex and expensive procedures. The solution to these problems could be multifunctional materials that are not only effective, but also do not become waste.

Therefore, the goal of the project is to investigate the possibility of using novel task specific pyridinium ionic liquids and their solid-state analogues (ionic liquid-modified silica and ionic liquid-modified poly(vinyl alcohol)-silica) as multifunctional materials (extractant/sorbent and oxidant carriers) for oxidative removal of organosulfur compounds from liquid fuels (fossil diesel and FOG-derived biodiesel).

The project involves comprehensive research that will allow for the development of process conditions dedicated to petrochemical products and their bio-analogues, as well as the selection of multifunctional materials (liquid and/or solid), which will be oxidant carriers and oxidation product carriers in the two-phase oxidative desulfurization process. It is also expected that the designed materials will have a protective effect on the oxidant or have a strengthening effect with the appropriate selection of the counterion (POM). They should also be characterized by high stability and easy regeneration, which will also ensure the circular of the desulfurization process. The work includes the use of specialist research techniques such as AFM, TEM, SEM, XPS, FTIR microscope, GC-GC TOF MS. Therefore, it can be concluded that the project will result in interdisciplinary research leading not only to a significant extension of knowledge and development of scientific field, but also to providing solutions perfectly in line with the principles of sustainable development and environmentally friendly technologies, both in economic, as well as environmental and social terms. The implementation of the planned work will allow for the development of processes focused on the possibility of reuse of raw materials with care for modern and environmentally and climate-friendly solutions in the field of fuels. Such activities are a response to the social demand for environmentally friendly products and services.