Proper waste management is currently one of the greatest challenges of the modern world. Most of the waste disposed of in landfills can be recycled into other valuable products while reducing potential pollution of the air, soil, and aquatic ecosystems. Every day, landfill gas (biogas) is released, mainly composed of ozone-depleting gases, including methane and carbon dioxide. To reduce the greenhouse effect, it is possible to harness biogas and transform it into valuable biomethane and then use it to produce heat, electricity, or as a transport fuel. However, in order to be able to use biogas for energy purposes, it must be properly cleaned. So far, much work has been done on the removal of carbon dioxide from biogas, while there is little work on the removal of the remaining pollutants present in biogas, i.e. volatile organic compounds (VOCs). The content of VOCs is much lower compared to the main components of biogas, but their presence may have a negative impact on the environment, including depletion of ozone in the stratosphere, the greenhouse effect, or a reduction in local air quality. In addition, in the combustion of biogas containing VOC, corrosion and much damage may occur to engines and installations converting biogas into energy. Therefore, an important aspect is the use of effective methods of biogas purification. Appropriate treatment technology should not only be selective and effective but also meet all standards of green chemistry, green engineering, and sustainable development. Among the known technologies, adsorption is one of the most popular techniques due to the high efficiency of the process without the need to use toxic chemicals. However, in order to ensure the high efficiency of the process, appropriate types of adsorbents should be used. A relatively new modification of the adsorption technique is the use of the so-called biosorption, i.e. the use of sorbents in the form of e.g. agri-food biowaste instead of conventional adsorbents. So far, the high efficiency of removing ions from aqueous solutions with the use of biosorbents has been confirmed, but there are no reports on the research conducted in the field of VOC removal from gaseous streams.

Therefore, as part of the project, research on the use of various types of biosorbents among others, fruit peel or nutshells to remove organic contaminants found in biogas streams, including organosilicon, organosulfur compounds, organochlorine compounds, and monoaromatic hydrocarbons. Moreover, as part of the project, in order to “fine-tune” the selectivity of individual sorbents and increase their sorption capacity, their surface was modified with the use of a new generation of green solvents in the form of deep eutectic solvents (DES). DES that will be synthesized under the project will be obtained only from cheap, non-toxic, and natural substances that can be easily obtained from plants or biomass. In addition, the project will investigate the adsorption capacity of biosorbents modified with the so-called SupraDES, which combine the properties of DES and cyclodextrins, thus constituting a new, promising class of green solvents. The literature reports that cyclodesctrins are compounds capable of efficiently absorbing VOCs. SupraDES containing cyclodextrins in the composition can therefore be an efficient and environmentally friendly biosorbent modifier. The project includes detailed research on the structural, morphological, and physicochemical properties of both impregnating materials and new biosorbents. Based on the conducted research, it will be possible to obtain a detailed insight into the interactions between biosorbents and individual VOCs. On the other hand, research on the kinetics of the removal of individual VOCs, research on the selection of favorable process conditions, as well as research on the regeneration of a new class of sorbents, will allow, after the completion of the project, to direct further development work towards the use of biosorbens for the treatment of real gaseous streams.

The use of waste materials impregnated with substances of natural origin for the selective purification of biogas streams will be a major scientific breakthrough. It should be mentioned that this will be the first research of this type, so it can be safely assumed that it is an innovative project in many aspects, and its implementation will certainly contribute to the development of the discipline.