In recent years, many scientists and technologists have been focused on implementing the principles of so-called *green chemistry*. The attention is being given to the extremely important work of decreasing the hazards related to the environmental pollution. For this reason, there is a drive towards new synthetic routes, free from toxic reagents and pollutants. Ionic liquids are the group of compounds gaining increasing importance in the field of chemistry, electrochemistry and environmental protection. One of the main advantages of these compounds is that they can be used as solvents for many organic substances. Ionic liquids find particular application in environmental protection, chemical engineering but also in the field of polymer chemistry, e.g. in the synthesis of copolymers composed of N,N-dimethylaminoethyl methacrylate and 2-hydroxyethyl methacrylate. Unfortunately, due to the good miscibility of ionic liquids with most solvents, their recovery and separation from the obtained polymer by classical separation methods is often inefficient. Moreover, the separation of the final product requires numerous unit operations, uses environmentally hazardous reagents, and generates an increased amount of harmful waste. That is why it is very important to conduct research on the simultaneous recovery of the ionic liquid and the purification of the product from the reaction mixture.

Therefore, the scientific objective of the project is to investigate the effectiveness of electrodialysis for the recovery of selected hydrophilic ionic liquids from the post-reaction solutions. The fundamental aspect of the research is the determination of the influence of selected electrodialysis parameters on its efficiency, and the development of the theoretical basis for solving the problem of recovery of ionic liquids from the post-reaction mixtures and for the purification of polymers (copolymers of N,N-dimethylaminoethyl methacrylate and 2- hydroxyethyl methacrylate). The planned research includes the non-obvious application of electrodialysis for the simultaneous recovery of ionic liquids from post-reaction solutions and purification of polymers. The important development presented here is the use the principle behind the electrodialysis: that only ionic substances migrate in an electric field across ion-exchange membranes.

The implementation of the project includes the conduct of basic research. The research tasks include:

- ✓ determination of the efficiency of electrodialytic recovery of selected hydrophilic 1,3-dialkylimidazolium ionic liquids from post-reaction solutions,
- ✓ determination of the effect of ionic liquid concentration, presence of polymer in the diluate, current density, linear flow velocity and type of membrane (homogeneous, heterogeneous) on the transport of selected 1,3-dialkylimidazolium ionic liquids through ion-exchange membranes,
- ✓ verification of the occurrence of fouling of ion-exchange membranes,
- ✓ development of a mathematical model allowing for the estimation of recovery efficiency and separation of ionic liquids from post-reaction solutions by the proposed method,
- ✓ determination of the chemical stability of the recovered ionic liquids and the possibility of their reuse.

The proposed solution is a breakthrough in the environmental protection, in chemical and process engineering, and in the methods of ionic liquids recovery and their separation from N,N-dimethylaminoethyl methacrylate and 2-hydroxyethyl methacrylate copolymers solutions. The project will also result in the development of a model of ionic liquids transport across the ion exchange membranes, which will allow the estimation of electrodialysis efficiency. The proposed solution, consisting of the simultaneous recovery of the ionic liquid and polymer purification, will allow to decrease the amount of environmentally harmful reagents and waste, and to improve the product purity, which is difficult with the commonly used methods.

The proposed research has an innovative character, allowing the complementary combination of chemical engineering and organic chemistry with membrane technologies, which so far have not been used in this type of applications. In the future the results of the project may contribute to a new research direction in the field of membrane technologies applications in the environmental protection and chemical engineering. **The research plan of the proposed project also includes the cooperation with a leading foreign scientific center: KU Leuven, Department of Chemical Engineering, one of the top hundred universities in the world according to the popular scientific rankings.** Furthermore, the results of the research may provide an important basis for the planning of further applied research, as well as the development of environmentally friendly techniques for the recovery of ionic liquids from post-reaction solutions. The results will be presented at international scientific conferences, published in reputable international scientific journals and will be the basis for habilitation procedure of the Principal Investigator.