SUMMARY OF DOCTORAL DISSERTATION

The studies on the use of alternative catalytic systems in olefin metathesis

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The main goal of the doctoral dissertation was the research on the development of alternative catalytic systems for olefin metathesis, as well as the search for reaction conditions ensuring effective catalyst recycling and obtaining the final product with high purity and a low waste ruthenium compounds content. Trends in green chemistry and economic aspects of the developed methods were an important part of the studies.

In the doctoral thesis, three different catalytic systems based on the commercially available, popular metathesis catalyst (Hoveyda-Grubbs 2nd generation - HG2) and innovative ionic liquids (Bio-ILs) based on natural raw materials such as carbohydrates, sugar acids or amino acids were used.

In the beginning, the research was carried out on the use of Bio-ILs or deep eutectic solvents (DES) as alternative solvents for olefin metathesis. It has been shown that, compared to organic solvents, Bio-ILs and DES dissolve the catalyst well, enabling easy isolation of the final product with a low Ru content and recycling of the catalyst to the next cycle. Unfortunately, they do not stabilize the ruthenium complex enough to enable effective recycling of the catalyst several times.

The rest of the work presents the research on the use of alternative surfactants based on Bio-ILs in metathesis reactions carried out in water. Tested Bio-ILs showed high surface-active properties, facilitating the reaction of hydrophobic reagents in water.

In the last stage of the research, heterogeneous catalysts were prepared by immobilizing the HG2 catalyst on nanocarbon support (MWCNT) and nanocarbon supports modified with ionic liquids (SILP, SILLP) as a matrix immobilizing the active phase. It has been shown that the modification of the ILs carrier ensures effective immobilization of HG2 on the surface, which has a positive effect on the purity of the product and the course of the metathesis reaction, and enables effective recycling of the catalyst into several reaction cycles.

The catalytic systems developed as part of this doctoral thesis are an effective solution that allows eliminating some of the disadvantages of olefin metathesis. The utilization of cost-effective catalysts along with the process's benefits results in environmentally-friendly and consequently more competitive approaches to olefin metathesis when compared to current methods.