

Title: Poly(2-oxazoline)-based molecularly imprinted polymers for selective removal and quantification of organic contaminants from environmental samples.

1. The goal of the project

The aim of the project is synthesis of a new group of poly(2-oxazoline)-based molecularly imprinted polymers (MIPs), their application in selective preconcentration, and quantification of various organic contaminants present in environment (pesticides, fluorinated organic compounds, antibiotics). During realization of the project a correlation between the structure of poly(2-oxazoline)-based MIPs and their effectiveness in solid-phase extraction (SPE) of particular analyte will be investigated. As poly(2-oxazoline)s possess high synthetic versatility, it will be possible to examine the influence of side-chain composition or the presence of particular functional groups onto adsorption efficiency. The proof-of-principle demonstration of poly(2-oxazoline)-based MIPs will be performed by examining their efficiency during analysis of real-life samples containing mentioned organic contaminants. The method validation will be performed to characterize all important analytical parameters of the newly developed determination procedures.

2. Research description

The research will be conducted during four work packages (WP). During the realization of the first WP, a series of short-chain poly(2-oxazoline)s of various composition will be obtained. Five different monomers will be used for polymerization which will result in obtaining polymers with various compositions and different physicochemical properties. Moreover, polymers with two different types of side-chain modifications will be obtained, which will result in possibility to cross-link them using different reactions. In the second WP the obtained short-chain poly(2-oxazoline)s will be cross-linked in the presence of template molecules (pesticides, fluorinated organic compounds, antibiotics) to obtain final MIPs. The structures of MIPs will be varied in order to obtain MIP which is best suited for particular template. In third WP a detailed examination of interactions occurring between MIPs and analytes (templates after removal from MIPs cavities) will be investigated (such as affinity or maximum adsorption capacity). The measurements performed in this WP will allow also to establish materials that can be used for water purification out of examined analytes. In the final WP, the obtained MIPs will be used for quantification of analytes. The materials which showed highest affinity in previous WP will be combined with analytical techniques in order to improve limits of detection and linearity of currently used methods.

3. Reason for conducting the research

Molecularly imprinted polymers are a special group of polymers that are prepared in the presence of a template that acts as a scaffold during the formation of a 3D cross-linked polymer network structure. Removal of the template molecules after synthesis allows obtaining MIPs selective towards the template molecules. Recently, the author of this project has obtained for the first time a poly(2-oxazoline)-based MIPs that possess a large potential for developing a new group of MIPs due to their very high imprinting capacity. The proposed project is therefore focused on in-depth investigation of this new group of MIPs in order to evaluate the influence of their structure onto the observed properties.

4. The most important expected effects

The most important effect in finding optimal MIPs structures designed for particular analyte. The results obtained will be very important to the field of polymer and materials chemistry. The second most important effect of the project is examining the effectiveness of obtained MIPs in preconcentration of particular analytes. These results will be important for the development of the research field of analytical chemistry and environmental science.