Project title: "A new analytical technique for quantification of organic compounds based on ambient mass spectrometry and molecularly imprinted polymers"

Reasons for choosing the research topic

Quantification of organic compounds in samples requires using appropriate apparatus and conducting certain operations over the sample, such as precise metering or preparation for final analysis. All operations taken over the sample are known as analytical process. Each stage of every analytical process is burdened with a constant systematic error and the possibility for the occurrence of a random error (i.e. as a result of error made by person carrying out an analysis). Due to the fact that such errors sum up and altogether become a total error of particular analytical method, much effort has been put to minimize the amount of operations conducted over a sample which are necessary to perform the analysis. The commonly used solution is extraction of an analyte (a substance whose content is being determined) into a solid phase, which means that the analyte will become "trapped" inside the structure of an appropriate adsorbent. In most analytical processes analyte is subsequently washout from the adsorbent by appropriate solvent or solution. The use of this procedure has additional advantage, because the solvent or solution used do not contain any substances that could cause interferences during performing the final analysis. Contrary, in the sample provided to the analysis substances that can effectively prevent the execution of a correct analysis can be present. This means that application of the extraction procedure described allows to remove substances that can prevent successful analysis. Further improvement of analytical process would be the possibility of direct analysis of adsorbent which possess analyte "trapped" inside. It would enable to eliminate generally tedious procedure of washing out the analyte.

Objective of the project

The aim of this project is to use molecularly imprinted polymers for the extraction of trace organic compounds and subsequently directly analyze them with the use of ambient mass spectrometry. Molecularly imprinted polymers are intelligent polymers that were designed and synthesized in such a way, that they are capable to selectively adsorb only one, particular analyte. Ambient mass spectrometry is very sensitive analytical technique, which allows direct analysis of compounds that are present in the solid samples. The combination of molecularly imprinted polymers and ambient mass spectrometry will allow to develop a new, highly sensitive analytical technique.

Research to be carried out

During the research project presented, molecularly imprinted polymers that will adsorb only one particular analyte from the samples, will be synthesized in the first place. The composition and a method of synthesis of these polymers will be refined in order to obtain polymers that possess the highest affinity towards particular analytes. Subsequently, the polymers obtained will be used for adsorption of analytes and afterwards they will be examined with the use of ambient mass spectrometry. Performing a series of measurements will allow determination of the parameters that are necessary for proper characterization of analytical technique, such as detection limit, linearity and influence of interfering compounds. Usability of the proposed analytical technique will be tested by using it to quantify organic compounds in real life samples. The results obtained will be compared with results of commonly used analytical methods.