ABSTRACT

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Title of the Dissertation Thesis:

Development of novel approaches to automated sample preparation for pharmaceutical and environmental analysis

Since their introduction 60 years ago, flow techniques have become a popular tool for automation of various analytical processes and were applied in environmental, pharmaceutical, or food analysis. Above all, they are recognized for the small consumption of reagents, fast analysis in an automated manner, the possibility to study kinetics of the reactions, and their versatility of the operation.

This dissertation contributes to the field of automation of sample preparation and leaching studies of the environmental pollutants using flow techniques, mainly the technique Lab-In-Syringe. The theoretical part gives the reader some insight into the possibilities and advantages of automation, with emphasis to flow techniques. This section is divided into three main chapters with the first one dedicated to automation. The four subchapters are focused mostly on the flow techniques and their general principles, different instrumentation, and hyphenation with detectors. The second chapter describes the most frequently used sample preparation techniques and the possibilities of their automation. The third chapter reviews bioaccessibility studies of environmental contaminants and the ways how to automate them.

The experimental part consists of six publications and brief comments describing the novelty, the main and outstanding characteristics, and the results of each work. The first and second publication were focused on automation of in-syringe dispersive liquid-liquid microextraction for trace metal analysis in various matrices with and without back-extraction to the aqueous phase prior to inductive coupled plasma-atomic emission spectrometry. The third project was dealing with the development of direct-immersion single drop microextraction by Lab-In-Syringe technique in two different configurations of the syringe. The method was applied to the determination of lead in tap water. The fourth work described Lab-In-Syringe dispersive liquid-liquid microextraction with a continuous flow of the sample. This new method was applied to the determination of nitrophenols in the surface water using multivariate spectral analysis. The fifth project was dealing with the automation of homogeneous liquid-liquid extraction using the salting-out phenomenon with posterior preconcentration on the anion-exchange resin in one on-line system with liquid chromatography. The method was applied for to determination of sulphonamides in urine. The last work introduced a flow-based platform for automation of the dynamic leaching study of the plastic additives from microplastic to the seawater.