# STRESZCZENIE W JĘZYKU ANGIELSKIM

Chromium occurs in the natural environment in two species form - Cr(III) and Cr(VI) which are dissimilar in terms of chemical behaviour, biological activity and toxic effects. The speciation analysis of chromium in environmental matrices is then of great importance and much research has been devoted to this area. However there is still need to develop the selective methods for determination of chromium species in such samples. Due to the low contents of Cr(III) and Cr(VI) forms in the environment, it is needed to introduce analyte initial separation step using solid sorbents into the analytical procedure. The main aim of the dissertation was then synthesis of new sorption materials selective towards the Cr(III) ions based on an ion imprinted polymers (IIP) technology. These novel materials were tested for selective binding of chromium species from environmental samples.

The first part of the research is the literature review consisted of 4 chapters. In the first chapter the occurrence of chromium in the natural environment and its chemical properties are presented. Next, the areas of chromium application and the main sources of its emission are described. Due to different toxicity of chromium species, the special attention is paid to the impact of chromium compounds on living organisms. Different problems related to the chromium speciation in the natural environment, their stability and transformation processes are also presented. In the next chapter the methods used for chromium speciation analysis, with special regard to separation of chromium species by extraction and chromatographic techniques before their determination by spectrometric techniques, are reviewed. The latter chapter describes the ion imprinted polymers (IIP), the schemes of ion imprinting processes and polymerization methods. The influence of particular reagents of the polymerization reaction on the properties of IIP is also discussed and the methods used to characterize physicochemical properties of polymers are presented. Finally, the review of literature on practical applications of ion imprinted polymers as selective solid sorbents for solid phase extraction is presented.

The experimental part of the dissertation describes studies on the design and synthesis of the IIP, which can be practically used for the speciation analysis of chromium. Due to the fact, that the polymerization reagents have a huge impact on the properties of these materials, several Cr(III)-ion imprinted polymers and control polymers with various ligands, functional monomers, crosslinking agents, initiators and porogens have been synthesized. The

sorption materials were prepared using complexes of Cr(III) with 1,10-phenanthroline, 2-aminobenzothiazole, 1-phenyl-3-methyl-4-benzoyl-5-pyrazolone and 8-hydroxyquinoline as a template. Methacrylic acid, styrene, acrylamide or 4-vinylpyridine were used as a functional monomers and divinylbenzene or ethylene glycol dimethylacrylate as a crosslinking agents. Synthesis of IIP was carried out by bulk polymerization in the presence of 2,2'-azobisisobutyronitrile or lauroyl peroxide as an initiators and ethanol, acetonitrile or chloroform as a solvent. The obtained sorbents were characterized in terms of physicochemical and sorption properties. The physicochemical characteristic of Cr(III)-IIP was carried out by different techniques like scanning electron microscopy, infrared spectroscopy and low temperature nitrogen adsorption/desorption. The sorption properties of IIP were studied in the dynamic mode using these materials as sorbents in the solid phase extraction. The separation (retention and elution) conditions of Cr(III) ions were optimized and the selectivity, stability and sorption capacity of polymers were studied. New methods for the separation of Cr(III) ions from aqueous solution by Cr(III)-ion imprinted polymers prior to their determination by electrothermal atomic absorption spectrometry have been developed. Then, analytical performance of designed methods was evaluated. The sorbents characterized by the best sorption properties and the highest selectivity towards chromium ions were used for the separation of Cr(III) ions from tap water samples. This dissertation is completed with a discussion on the impact of the individual reagents used in the polymerization reaction on the properties of ion imprinted polymers.

Based on the results of these studies, it was concluded that obtaining of high specific and selective Cr(III)-ion imprinted polymers depends on the matching appropriate ligand complexing Cr(III) ions and functional monomer in a complementary fashion. It provides high efficience of a template – monomer complex formation and high stability of forming binding sites. The type of solvent, which is responsible to the formation of pores in the polymer structure ensuring easy transfer of analyte to the binding sites, also affects on the selectivity of the polymers. Synthesis of IIP-fen($4_{ACN}$)ST-AIBN by using 1,10-phenanthroline, styrene and divinylbenzene carried out in the presence of 2,2'-azobisisobutyronitrile and acetonitrile allowed to obtain a new sorption material characterized by high selectivity towards chromium species, which can be applied to separation of Cr(III) ions from tap water samples.

30.04.2018

Laura Trzonkowska