ABSTRACT (EN)

The presented dissertation thesis summarizes the results contained in five original research papers that were published in prestigious international scientific journals in the field of analytical chemistry and atomic spectrometry. It is devoted to the method of generation of volatile compounds using a tetrahydroborate reaction and detection in a quartz multiatomizer by atomic absorption spectrometry. The thesis can be divided into two thematic parts – speciation analysis of arsenic based on hydride generation technique with collection and separation in a cryogenic trap and generation of volatile species of transition metals.

In the first thematic part pre-reduction of pentavalent inorganic and methylated arsenicals has been studied. A simple setup for on-line pre-reduction employing thioglycolic acid as a fast pre-reductant has been developed, connected with a current hydride generator and applied/verified to oxidation state specific arsenic speciation analysis of human urine samples. In the same method the possibility of drying the gaseous phase from water vapor has been investigated to avoid incidental blocking the cryogenic trap by frozen water and to decrease fluctuations of signal baseline. Pronounced losses of methylated species have been discovered on Nafion tube dryer currently used in analytical atomic spectrometry. Such behavior can lead to serious errors in determination by the methods where hydride generation step is involved. The sodium hydroxide dryer has been suggested as a possible and safe alternative.

In the second thematic part generation of silver and gold species by the tetrahydroborate reaction has been thoroughly investigated. A considerable effort has been made to identify the volatile analyte species released to the gaseous phase. Transmission electron microscopy experiments as well as a detailed aerosol study have proven the formation of nanoparticles and their transport by the carrier gas to the atomizer along with aerosol droplets. The analyte transfer within the generator has been studied using ^{111}Ag and ^{198,199}Au radioindicators and efficiencies in each individual process of generation have been determined. These radiotracer experiments have contributed to the improvement in the design of the generator and atomizer so that generation efficiency as well as limits of detection could be enhanced significantly.