

SUMMARY

The aim of the thesis was to develop a methodology for isolating and determining a selected group of volatile organic compounds on a variety of sorption materials for determination (both qualitative and quantitative) of the compounds by gas chromatography coupled with mass spectrometry (GC/MS). Structurally the simplest halogenated aliphatic hydrocarbons commonly used in chemical industry, such as chlorinated methanes, were selected for the studies. The compounds pose a problem as regards pollution of groundwater, a devastating impact on the ozone layer or a neurotoxic and probably carcinogenic effect on the human body. The theoretical part of the paper presented a review of the literature concerning characteristics of the selected group of volatile organic compounds, sources of formation, and applications. Both metabolism and toxic effects on the human body were discussed. Finally, a review on sample enrichment techniques based on solid - gas adsorption phenomena and the use of various types of combined chromatographic techniques in the analysis of chlorinated methanes was presented.

In the experimental part testing and modeling of sorption processes on the selected group of compounds with the use of systems and sorption materials such as modified silicas, porous, polymer and mixed adsorbents were carried out. Characteristics of sorbents were defined on the basis of experimentally determined low-temperature nitrogen adsorption isotherms and isotherms determined by gas chromatography. It was proposed to combine thermal desorption (TD), solid phase microextraction (SPME) and the needle trap (NT) coupled with gas chromatography-mass spectrometry for the adsorption-desorption studies of selected analytes. As a result of the conducted research, a combination of commercially available sorbents differs in surface and structural properties and consequently in selectivity was suggested. Hence, an isolation of dichloromethane, trichloromethane and tetrachloromethane from the air, an enrichment of the sample components, and a subsequent desorption and effective transfer to a column of gas chromatography coupled to mass spectrometry detection were allowed. "Model systems of sorption" for chlorinated methanes using thermal desorption tubes - Tenax TA/Carbopack B/Carboxen 569 (60/80/150 mg), SPME fibers - 75 μ m Carboxen 1006/PDMS and NT - Tenax TA/ Carbopack X/ Carboxen 1000 (11/10/11 mm) were developed. Basic validation parameters i.e. linearity in the range of method's measurement, precision (reproducibility), limits of quantification and detection were set for each of the method.

Developed "sorption models" and methods for detecting analytes were verified in conditions of the natural environment by carrying out measurements using all of the sorption techniques in the laboratories of chemical analyses and also with an application of NT and TD at the workplaces where paint and varnish were removed from different kinds of industrial materials.