Fractionation analysis – SPE Study Application

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Abstract. The toxicity of metal elements, their mobility in the environment and ability to accumulate in living and nonliving systems nearly relate with their chemical forms. Information about their total concentration provides only a little information about their potential risk. In final period in the field of environmental science is collecting great respect at chemical speciation, which arise from requisites to determine concentration especially species characterized with big toxicity and mobility in the environment. Fractionation is process of classification of an analyte or group of analytes from a certain sample according to physical (e.g., size, solubility) or chemical (e.g., bonding, reactivity) properties. We have study the efficiency of Cu, Pb, Cd and Zn extraction in dependence on column type and conditioning style. By application both type columns with decreasing concentration of elements in model solutions the extraction efficiency growth. Maximum extraction efficiency was achieved at element concentration in model solution = 100 ppm, another decreasing concentration makes efficiency invariable. Advanced extraction efficiency was achieved by using columns type Merck.

Key words: fractionation, solid phase extraction (SPE)

Introduction

The concept of using an adsorbent material to extract trace organic compounds from an aqueous sample was developed in the 1980s, and its application has been extensively reviewed (Dressler, 1979, Poole at al., 1983). Sorbents are now used to extract organic compounds from various matrices including water, air and event soil. A sorbent with a strong affinity towards organic compounds will retain and concentrate those compounds from a very diluted aqueous or gaseous sample. Many sorbents are specifically suited for the extraction of different groups of organic compounds with various degrees of selectivity. One widely used sorbent technique is solid phase extraction (SPE). The first step of SPE is to pass a liquid matrix through a plastic cartridge or flat membrane containing
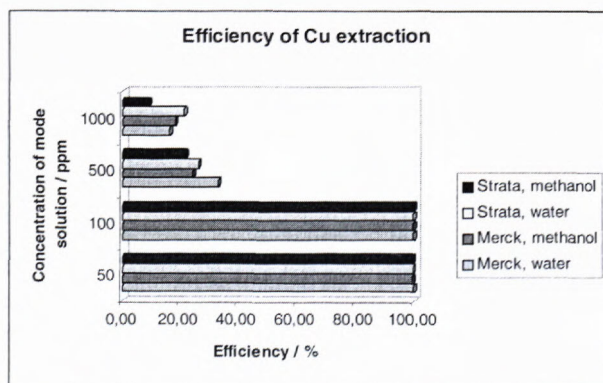

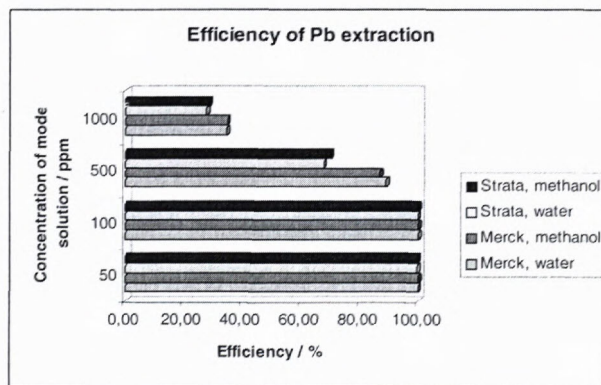*Fig. 2: The efficiency of Pb extraction in dependence on column type and conditioning style.*

Fig. 1: The efficiency of Cu extraction in dependence on column type and conditioning style.
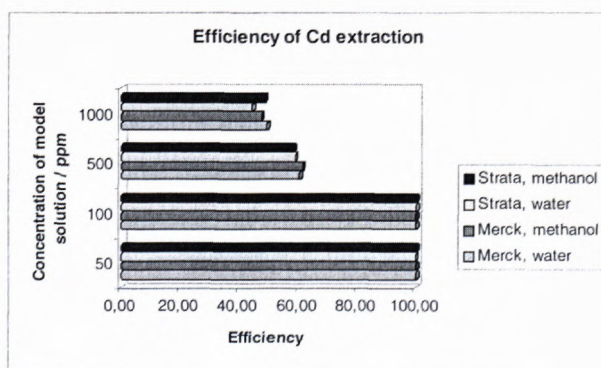

Fig. 3: The efficiency of Cd extraction in dependence on column type and conditioning style.
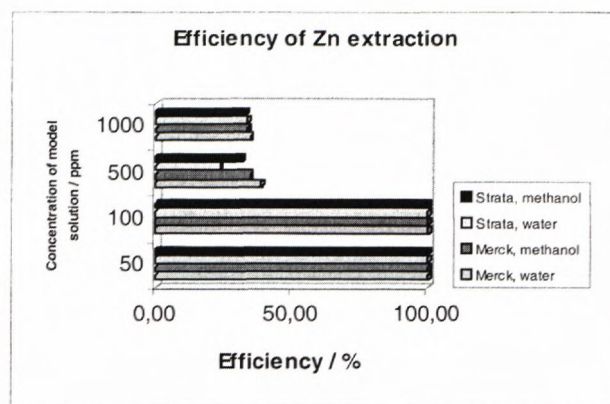
Fig. 4: The efficiency of Zn extraction in dependence on column type and conditioning style.

sorbent dispersed on a particulate support to extract analytes together with interfering compounds (Hagen at al., 1990). Usually, a selective solvent is used to remove interferences first, and then another solvent is chosen to wash out target analytes. SPE has a number of attractive features compared to traditional solvent extraction. SPE is simple, inexpensive, and uses relatively little solvent (Pawliszyn, 1997).

Experimental

Model solutions relevant metallic cations were prepared from hydrate their nitrates cleanness p.a. by melting in 2 times redistilled water. Volume of model solutions was whenever 100 ml. On preconcentration they were employed column Merck LiChrolut SCX 500 mg and Strata SCX 500 mg with volume 3 ml. Columns were conditioning by two ways. By 2 times redistilled water with pH = 5,09 and by mixture of methanol and 2 times redistilled water in the ratio of 1:1 with pH = 6,59. Model solutions were preconcentrated behind tension cut-down at 20 kPa by water air pump. Time of preconcentration was about 45 min. The determination of analytes was carried out with flame atomic absorption spectrometer, the Varian model A-20 plus equipped with deuterium lamp for background correction and air/acetylene flame.

Results and discussion

By application both type columns with decreasing concentration of elements in model solutions the extraction efficiency growth. Maximum extraction efficiency was achieved at element concentration in model solution = 100 ppm, another decreasing concentration makes efficiency invariable. Advanced extraction efficiency was achieved by using columns type Merck.

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