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Synthetic zeolites as sorbent material for on-line preconcentration of copper traces and its determination using flame atomic absorption spectrometry

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Abstract

This work assesses for the first time the potential of synthetic zeolites as adsorptive material for the preconcentration of copper traces. This involves the formation of a copper chelate, its adsorption on sodium lynde Type A (Na-LTA) and sodium faujasite Type X (Na-Fau) synthetic zeolite minicolumns, and its elution with 300 μl of methyl isobutyl ketone. Using 5–80 mg of either sorbents materials with a loading time of 2 min per sample preconcentration factors of copper ranging from 35–125 for Na-LTA and 30–65 for Na-Fau were readily achieved related to the direct introduction of aqueous solutions into an atomic absorption spectrometer. To evaluate the performance of these materials, a flow injection system was used for samples of water from different sources, and the accuracy was assessed through recovery experiments and the analysis of certified reference materials. A parallel experiment was performed with polygosyl bonded silica reversed-phase sorbent with octadecyl functional groups (RP-C_{18}) as sorbent in the minicolumn in order to study the performance of this well-known material as a reference for the new sorbents. The 3σ detection limits, relative standard deviation and linear calibration graphs were, respectively, 0.1 ng ml^{-1}, 2.6% and 2.5–30 ng ml^{-1} for Na-LTA and 0.4 ng ml^{-1}, 2.8% and 2.5–40 ng ml^{-1} for Na-Fau for preconcentration times of 2 min.

Keywords: On-line preconcentration; Synthetic zeolites; Flow injection; Copper; Atomic absorption spectroscopy

1. Introduction

The papers on flow injection atomic spectrometry (FI-AS) systems used for preconcentration purposes that have been found in the literature could be classified in three groups: liquid–liquid extraction, column preconcentration and precipitation, according to the basic mechanism of the preconcentration step [1,2].

Particularly, solid-phase extraction (SPE) is a preconcentration technique of rapidly growing importance in trace metal determination, which can be easily adapted to FI on line separation and preconcentration systems [3]. The main advantage of this is the possibility of using a relatively simple detection

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