

Solid-Phase Extraction of Trace Elements Using a Macroporous Sintered Material Containing Chelating Resin

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Summary

A solid-phase extraction (SPE) using chelating resin is one of the most useful techniques for separation of trace elements because the operation is simple. A particulate chelating resin immobilizing carboxymethylated polyethyleneimine (CM-PEI) has excellent ability for separation of trace elements. The CM-PEI resin can extract some trace elements, such as Cd, Cu, and Pb, over the wide pH range; however, alkali and alkaline earth elements are not collected under acidic and neutral conditions. The SPE using CM-PEI resin is generally conducted using a cartridge packed with the particulate resin. If the other shape of SPE material can be prepared, it will be conveniently utilized in various fields. In this study, we tried to apply the sintering technique to prepare various shapes of SPE materials containing CM-PEI resin.

A sintered material was prepared as follows: The equal amounts of CM-PEI resin (Presep PolyChelate, Wako Pure Chemical Industries) and powdery polyethylene (Flo-Thene, Sumitomo Seika Chemicals) were mixed, and then the mixture was added to a mold. The mold was heated at 130 °C for 20 min. After cooling, plate-type sintered material (thickness, 3 mm) was obtained. The sintered material was cut into a disk shape (diameter, 47 mm); it was used to set on a commercially available filtering apparatus with a handmade PTFE gasket.

When the SPE of 21 kinds of elements were conducted using the disk-type sintered material, almost the same results were obtained compared to that using the powdery chelating resin used for the preparation. This result indicates that the ability of the chelating resin in the sintered material for separation of trace elements is not changed after the sintering process. The disk-type sintered material was able to quantitatively extract 11 kinds of elements (Cd, Co, Cu, Fe, Mn, Mo, Ni, Pb, Ti, V, and Zn) at pH 5.5 at the flow rate of at least 70 mL/min. The SPE was applied to separating trace element prior to their inductively coupled plasma atomic emission spectrometric determination. The combined method was useful for the analyses of certified reference materials (EnviroMAT™ Ground Water ES-L-1 and Waste Water EU-L-3, SCP Science). The method was also applicable to the analysis of a commercially available table salt.