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Development of Hybrid Coprecipitation Method Using Magnesium as a Carrier and Its Application to Determination of Trace Metals in Salts

Shigehiro Kagaya

Faculty of Engineering, University of Toyama

Summary

In this work, a simple separation method based on the rapid coprecipitation technique using yttrium and magnesium as a carrier has been developed for determination of 11 trace metals in 100 mL of saline water such as seawater and table salt solution. The sample solution, which contains magnesium, was taken into a 175 mL of polystyrene centrifuge bottle. To the solution, 5 mL of 2.0 mol L^{-1} nitric acid and 1 mg of yttrium were added. Precipitate was formed after adding 3.7 mL of 3 mol L^{-1} sodium hydroxide solution; Be, Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb could be quantitatively coprecipitated with formed precipitates, hydroxides of yttrium and magnesium. The solution was allowed to stand for approximately 10 min. After centrifugation at 3,500 rpm for 5 min, supernatant solution was discarded. Purified water (10 mL) was added to the centrifuge bottle, and then it was shaken by hand. The precipitate was re-centrifuged and dissolved with 5 mL of 1 mol L^{-1} nitric acid. The metals in the solution were determined by inductively coupled plasma atomic emission spectrometry; yttrium was used as an internal standard. In this method, a blank test was easily carried out because yttrium also plays a role as a carrier. The detection limits ranged from 0.001_6 μg (Mn) to 0.22 μg (Zn) in 100 mL of sample solutions. Operation time required for separation of 11 elements was approximately 30 min. The proposed coprecipitation method was applicable to separation of 11 metals in certified reference material (ground water, ES-L-1) and table salt solutions.