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Development of determination method for trace elements in salt made from deep seawater by ICP-AES after separation using an international standardization-assisted rapid coprecipitation technique

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Summary

Coprecipitation technique has been investigated for separation of some trace elements in salt prior to their determination by inductively coupled plasma atomic emission spectrometry (ICP-AES). Beryllium(II), chromium(III), manganese(II), iron(III), cobalt(II), nickel(II), copper(II), zinc(II), arsenic(V), selenium(IV), cadmium(II), antimony(III), and lead(II) ions in concentrated salt solutions, such as seawater or sodium chloride and sulfate solutions, were collected quantitatively by coprecipitation with hydroxides of ytterbium(III), gallium(III), and magnesium(II). In this method, a rapid coprecipitation technique combined with internal standardization was applied to simplify the operation; yttrium was used as an internal standard. The 13 elements collected were readily determined by ICP-AES using internal standardization. The detection limits (3σ , $n=10$) were in the range of 0.003 μg (for beryllium(II)) to 0.13 μg (for zinc(II)) in the initial sample solution (up to 150 mL). The proposed method was applied to analyses of some commercially available salts as well as the certified reference materials; the elements ranging from 0.03-0.14 $\mu\text{g g}^{-1}$ in the salts or 0.006-0.30 mg L^{-1} in the certified reference materials could be determined with the relative standard deviation of 7-33 % or 2-17 %, respectively. The time required for the separation was approximately 20 min.