

The Study on the Separation among +1, +2 and +3 Valences of Metals using CE and ESI-MS for the Detection of Metal Species in Seawater

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Summary

It is very difficult to characterize metal species in seawater, because it contains a lot of metals. These metals prevent the measurement of the minor metal species. Therefore, the measurement system to remove the salts from seawater efficiently is required. The concentration of metal in seawater is so low that Electrospray Ionization Mass spectrometer (ESI-MS) was required to detect metal species in solution. Therefore, capillary electrophoresis (CE) was adopted, because the separation condition of metal species from salts by the capillary should be milder than that of HPLC and ion chromatography.

In order to characterize metal species in seawater, the coupling of CE and ESI-MS (CE-MS) has been developed. To measure metal species, ESI interface was required with the facility. ESI voltage is simultaneously applied with nebulizing at the tip. Therefore, an ESI interface was modified to connect CE and ESI-MS. In this study, strontium was used as a metal speciation target.

1) A solution containing strontium was measured by ESI-MS and CE-MS, respectively. And cesium, magnesium, calcium, barium, yttrium, lanthanum and aluminum ions could be observed by both ESI-MS and CE-MS. In this study, strontium was used, because the strontium concentration in seawater is 7-8 ppm. To measure seawater, strontium should to be a probe to detect metal species. Although some of strontium species observed by CE-MS agreed with those observed by ESI-MS, some complexes derived from CE electrolyte, which is acetic acid, were also observed by CE-MS. It was confirmed that the composition and condition of the CE electrolyte gave highly effective influences in metal species by CE-MS analysis, and should be improved to detect metal species while keeping their original chemical forms in the solution.

2) NaCl or KCl was added to a strontium solution, and these matrix solutions were measured by ESI-MS and CE-MS. In analysis by ESI-MS, the ionization of strontium species was prevented by the coexisting matrix, such as KCl, in solution. However, the strontium species could be detected by CE-MS without suppression caused by the component of the matrix.

Therefore, It should be expected that the CE-MS will become a useful technique to examine the metal species by removing matrix (*e.g.* NaCl, KCl and other salts), and will have a potential to obtain information of metal species in natural water.