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Extraction of Iodine in Natural Salt Water Using Ionic Liquids

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Summary

Iodine is a useful element with a wide range of uses and an important export resource in Japan. Solvent extraction is one of the effective methods for separating iodine, but conventional organic solvents basically extract only neutral I_2. On the other hand, since iodine is mainly present as an ionic species such as I^- in nature, the conventional solvent extraction method requires an oxidation process in advance. In this study, focusing on ionic liquids with excellent ion extraction ability, we investigate in detail the distribution behavior of I^- and IO_3^- in hydrophobic IL/water biphasic systems, and find an IL extraction system suitable for iodine extraction from iodine-rich natural brines.

The distribution ratio (*D*) data obtained for I^- and IO_3^- in various IL/water systems revealed that the *D* value greatly varies depending on the IL species. From analysis of the dependence of *D* value on the IL species based on the extraction mechanism, it was found that, in general, an IL composed of a more highly hydrophobic cation and a more highly hydrophilic anion has a higher extractability for these anionic species of iodine, and that the IL containing a protic cation has a specific high extractability. Specific interactions such as hydrogen bonding between the protic cation and I^- or IO_3^- are suggested. In comparison of I^- and IO_3^-, I^- is more highly extracted in all the IL/water systems studied.

From these basic findings, trioctylammonium chloride ([HTOA]Cl) was expected to be a suitable IL for effective extraction of I^-, and the extraction of I^- in brines with this IL was examined. As a result, it has been demonstrated that I^- can be quantitatively extracted into [HTOA]Cl at a volume of about 1/40 from an iodine-rich natural brine containing high concentrations of other ions such as Cl^-.