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Associate Professor

Program: Fundamental Sciences

Area: Chemistry

Undergraduate: Dept. of Science

Professional Expertise

- Solvent extraction and solid-phase extraction of metal ions from natural waters as an ion-pair with various alkylammonium ions and/or chelate extractants.
- Thermodynamics and kinetics of complex formation reaction in non-coordinating non-aqueous solvents and the structural aspects for related complexes in solids as well as in solution.
- Instrumental analysis of metal ions using atomic spectrometry such as atomic absorption spectrometry and inductively coupled plasma mass spectrometry.

Research Fields of Interest

Solvent extraction of ion-pair

- Most of anions in water can be extracted into organic solvents such as benzene, octane, and chloroform as an ion-pair with alkylammonium ions such as trioctylmethylammonium ion as a bulky hydrophobic cation. The extraction reaction and dimerization reaction and/or dissociation reaction of such ion-pair is precisely measured for gathering thermodynamic parameters and structural influence of cation and anion and the effect of solvents are clarified on the basis of solute-solute and solute-solvent interaction. Such results can be applied to design specific separation systems.

Solid-phase extraction of metal ions

- Recent trends of “Green Chemistry” requires non-toxic and re-usable separation system in the fields of Analytical Chemistry. Based on the knowledge of **solvent** extraction, he is trying the possibility of replacing the traditional organic solvent to solid phase extractants, which is some organic substituents such as octadecyl- and phenyl-group is chemically modified on silica-gel. The simple anion-tetraalkylammonium system and cobalt(III) complexes are now under testing for the extractabilities of such solid-phase extraction system. In addition, he tried to modify silica-gel by aminomethylenephosphonate group as a chelate extractant. The extractabilities of some metal ions and thermodynamic behavior are under examined.

Thermodynamic behavior of transition metal complexes in non-aqueous solvents

- Most transition metal ions are exist in 6-coordinated solvated structure such as $[\text{Co}(\text{OH}_2)_6]^{2+}$ in coordination solvents such as water. They can also take 4-coordinate structure, however, in non-coordinating solvents such as 1,2-dichloroethane. Such low coordination number state of metal ions is regarded as an intermediate state of catalytic cycle of metal ions. The thermodynamic behavior and steric effect of ligand has been investigated by spectrophotometry, calorimetry, and solvent extraction technique.

Instrumental analysis

- For the studies above, the commercially available instrument have been customized, such as automatic spectrophotometric titration system of u.v.-visible spectrometer and continuous flow detection system of ICP-MS system.

Education

1988: Ph.D., Graduate School of Science and Technology, Niigata University, Japan

1985: M.S., Graduate School of Science, Niigata University, Japan

1983: B.S., Faculty of Science, Niigata University, Japan

Professional Societies and Activities

1. Chemical Society of Japan
2. Japan Society for Analytical Chemistry
3. Japan Society of Coordination Chemistry
4. American Chemical Society
5. Japan Association of Solution Chemistry
6. Japan Association of Solvent Extraction

Major Publications

Papers

- [1] "Effect of substituent of β -diketones on the synergistic extraction of lanthanoids with linear polyether" *Talanta*, vol.84, no.4, pp.1047-1056, 2011.
- [2] "¹H-NMR studies on the ternary complexes of rare-earth ions with thenoyltrifluoroacetone and polyethers in dichloromethane" *Dalton Trans.*, pp.5495-5503, 2009.
- [3] "Synthesis, crystal structure, and chromotropic properties of mixed-ligand nickel(II) complexes with 1,3-diketonate and P-N bidentate ligands" *Bull. Chem. Soc. Jpn.*, vol.81, no.1, pp.127-135, 2008.
- [4] "Synergistic extraction and solution structures of ternary complexes of lanthanoids with 2-thenoyltrifluoroacetone and linear poly(oxyethylene) in 1,2-dichloroethane" *Bull. Chem. Soc. Jpn.*, vol.80, no.12, pp.2357-2364, 2007.
- [5] "Syntheses, crystal structures and chromotropic properties of nickel(II) mixed ligand complexes containing N-methyl-1,4-diazacycloheptane and various β -diketonates" *Polyhedron*, vol.26, no.8, pp.1570-1578, 2007.
- [6] "Structures of Linear Poly(ethylene oxide) Compounds and Potassium Complexes in Dichloromethane" *J. Phys. Chem. B*, vol.111, no.17, pp.4361-4367, 2007.
- [7] "Ion-Pair Solvent Extraction of EDTA Anions with Tetraalkylammonium Ions in Various Organic Solvents" *Monatsh. Chem.*, vol.137, no.11, pp.1375-1383, 2006.
- [8] "Crown Ethers as Synergist in the 2-Thenoyltrifluoroacetone Extraction of Lanthanoids in 1,2-Dichloroethane" *Monatsh. Chem.*, vol.137, no.8, pp.1015-1025, 2006.
- [9] "Adsorption of lanthanoid ions on calcite" *Dalton Trans.*, pp.3291-3296, 2005.
- [10] "Polymerization and complex formation of phthalocyanine substituted by trioxyethylene in solution" *J. Mol. Liq.*, vol.119, no.1-3, pp.171-176, 2005.
- [11] "Study on the Solute-Solvent Interactions Using the Solubility of Asymmetric Metal Complex, $\text{CoX}_2(\text{R-py})_2$, as a Probe of Interaction" *J. Solution Chem.*, vol.33, no.6/7, pp.711-720, 2004.
- [12] "Geochemistry and origin of the basal lherzolites from the northern Oman ophiolite (northern Fizeh block)" *Geochem. Geophys. Geosys.*, vol.4, no.2, Internet Journal, 2003.

[13] "Study of the adhesion mechanism of CaCO_3 using a combined bulk chemistry/QCM technique" *J. Cryst. Growth*, vol.245, no.1-2, pp.87-100, 2002.

[14] "Calorimetric study of nickel complex compounds with tmen as a ligand: determination of the energetic parameters for the δ - λ conformational change of the ethylenediamine framework" *J. Phys. Chem. Solids*, vol.62, no.3, pp.613-618, 2001.

[15] "X-ray diffraction and Raman spectroscopic study of bis-(pyridine base) complexes of cadmium(II) halogenides" *Monatsh. Chem.*, vol.132, no.10, pp.1145-1155, 2001.

[16] "Solvent effects on ion-pair distribution and dimerization of tetraalkylammonium salts" *Monatsh. Chem.*, no.132, vol.11, pp.1439-1450, 2001.

[17] "Thermal stability of pyridine base complexes of cadmium chloride" *Bull. Chem. Soc. Jpn.*, vol.74, no.7, pp.1285-1288, 2001.

[18] "Stability and structure of ethylenedinitriolpoly-(methylphosphonate) complexes of the divalent transition metal ions in aqueous solution" *Bull. Chem. Soc. Jpn.*, vol.74, no.3, pp.487-493, 2001.

[19] "Stability and structure of nitrilo(acetate-methylphosphonate) complexes of the alkaline-earth and divalent transition metal ions in aqueous solution" *Dalton Trans.*, no.6, pp.919-924, 2000.

Book Chapters

[1] Satoh, K. 2006, "Sample preparation" and "Standard materials" *A Laboratory Guide to Instrumental Analysis for Young Chemists*, Koudansya-Scientific, pp.13-25, 63-67.

[2] Satoh, K. 2004, "Complexon" *The Fifth Series of Experimentally Chemistry Vol. 22 Metal Complexes and Transition Metal Clusters*, Maruzen, pp.311-317.