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Synergistic Extraction and Structural Properties of Rhodium Chloride Complexes in the TOA–DHS and TOA–TDGA Systems

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Extraction of Rh(III) from relatively concentrated HCl solution (>1 M) is a difficult operation in the field of solvent extraction, and, to date, no effective extractant for Rh(III) has been developed for industrial use.^[1,2] We have found that *N,N*-disubstituted amide-containing tertiary amine compounds can extract much more Rh(III) from HCl solution than tri-*n*-octylamine (TOA).^[3,4]

In another approach, we have been interested in the synergistic extraction of Rh(III) from HCl solution using mixed solvent systems consisting of a tertiary amine compound and a neutral extractant. A synergistic effect for Rh(III) extraction from HCl has been found in the TOA–di-*n*-hexyl sulfide (DHS) and TOA–thiodiglycolamide (TDGA) systems.^[5] The extraction study of Rh(III) from 2 M HCl showed that the apparent stoichiometry of Rh(III):TOA:(DHS or TDGA) in the organic phase was 1:2:1. At 2 M HCl, almost all TOA molecules formed a 1:1 TOA:HCl complex, while the TDGA and DHS molecules were not involved in the HCl extraction. In addition, we investigated the coordination structure of the Rh chloride complexes extracted in the TOA–DHS and TOA–TDGA diluted in 1-octanol using FT-IR and XAFS measurements to clarify the extraction mechanism in detail. The structural study suggests that the inner-sphere of Rh(III) in the TOA–DHS is different from that in the TOA–TDGA systems.

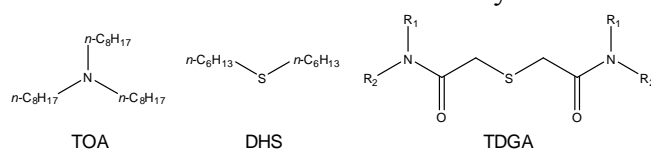


Figure 1 Structures of TOA, DHS and TDGA

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