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ION EXCHANGE BASED ON COMPLEXATION USING A CHELATING AGENT-LOADED RESIN

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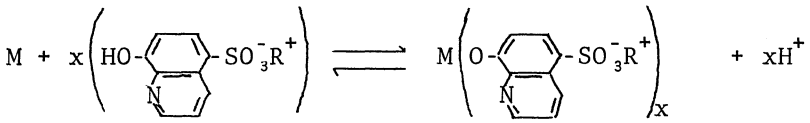
A chelating agent-loaded resin consisting of an anion exchanger and 8-quinolinol-5-sulfonic acid was prepared and the adsorption behavior of some metal ions was investigated in comparison with that toward a resin containing 8-quinolinol. Results showed that the chelate forming group in the former was effective for preconcentration and separation of divalent transition metals.

A chelating agent-loaded resin has been utilized for preconcentration and separation of trace elements in natural water samples. Main advantage of this method is that selective preconcentration by functional group of a chelating agent in the resin can be performed.

One gram of the anion exchanger, Diaion SA#100 (Cl type, 100-200 mesh) was added to an aqueous solution of 8-quinolinol-5-sulfonic acid or 8-quinolinol (1 g/ 50 ml). After standing for one hour, the mixture was filtered and washed with water. The resulting resins loaded with 8-quinolinol-5-sulfonic acid and 8-quinolinol are called A-resin and B-resin, respectively. Fifty milligrams of the dried resin was added to an aqueous solution containing 25μg each of metal ions and the pH of the solution was adjusted by adding hydrochloric acid or sodium hydroxide solution, the mixture was then diluted to 50 ml with water. After standing for 24 hours, the metal ions remaining in solution were determined by the atomic absorption analysis and the pH was also measured.

As is seen in Fig. 1, a plot of log D against pH for A-resin gives a straight line with a constant slope and the following sequence of 50% adsorption pH was observed: Hg (1.55) < Cu (1.95) < Zn (2.70) < Cd (3.45) < Mn (4.60). Except for iron(III) which may partially be hydrolized under our experimental conditions, the above sequence well agreed with the increasing order for 50% extraction pH obtained by employing 8-quinolinol(0.05 M)-chloroform system, i.e., Hg ($pH_{1/2}$ = 1.3) < Cu (1.51) < Zn (3.30) < Cd (4.60) < Mn (5.66).[1] In contrast, the adsorption behavior of metal ions for B-resin does not show any linear relationship (Fig. 2) and the above fact makes a quantitative explanation for the adsorption mechanism difficult.

In the case of A-resin, $-SO_3^-$ in the chelating agent is presumably adsorbed on the anion exchange resin, whereas the ion exchange site in the resin might be associated with the oxygen atom of 8-quinolinol in B-resin. Ion exchange ability of A-resin is attributable to the chelate forming group in 8-quinolinol-5-sulfonic acid:



where M and R^+ denote metal ion and resin matrix, respectively. On the other hand, ion exchange process using B-resin might be based, at least partly, on the inclusion of metal 8-quinolinolate in the matrix of the anion exchanger.

A-resin having an available chelate forming group will hopefully be employed for preconcentration and separation of trace elements. An actual application of the chelating agent-loaded resin to the neutron activation analysis will be published in future.

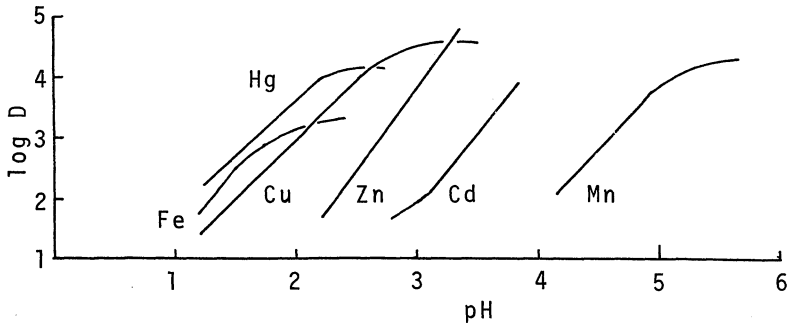


Fig. 1 Adsorption of metal ions on resin-A

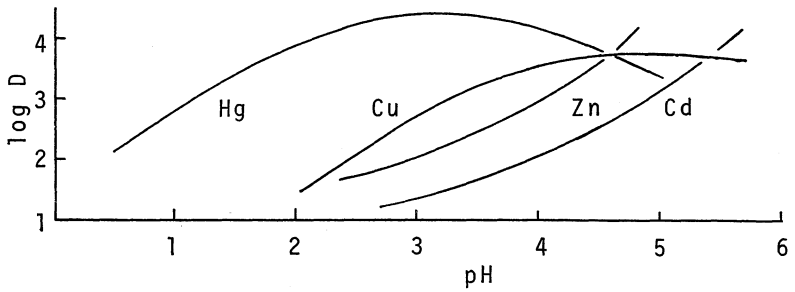


Fig. 2 Adsorption of metal ions on resin-B

Reference

1) J. Stary, The Solvent Extraction of Metal Chelates, p. 42, Pergamon Press, New York (1964).

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