SHORT COMMUNICATION

*Anion Exchange Separation of Arsenic (V) and Phosphorus (V) from Arsenic (III) and Germanium (IV)**

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Present study on the anion exchange in hydrochloric acid solutions showed the existence of striking difference in adsorbability between As (III) and As (V), i.e., As (III) was found to be considerably adsorbed by Dowex 2 resin in concentrated hydrochloric acid, whereas that of As (V) was negligible at concentrations between 2 and 12 M of the acid. As was expected, P(V) (Phosphate) behaved just in the same way as As (V). On the other hand, Kakihana[1] reported the excellent adsorbability of Ge (IV) in concentrated hydrochloric acid solutions.

In order to clarify the conditions necessary for the separation of these elements, the author determined the distribution coefficients *Kd* (amount per gram resin/amount per ml. solution) of As (III) and Ge (IV) as a function of hydrochloric acid concentration. The results of the equilibrium experiments[2] are shown in Fig. 1 indicating that both elements can be considerably adsorbed in the range more than 6 M HCl with maximum adsorption at ca. 10 M.

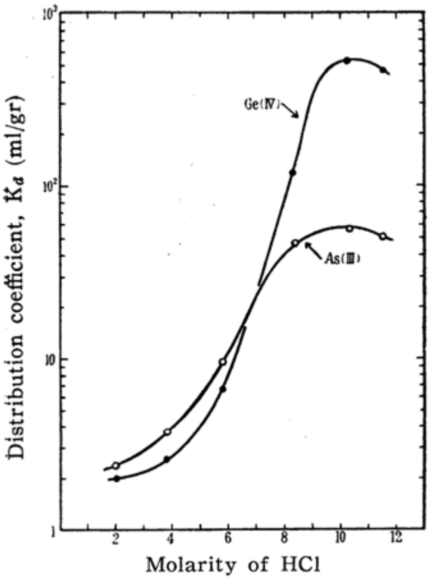

Fig. 1. Anion exchange adsorption of As (III) and Ge (IV). Dowex 2 (8% cross linked), 120-200 mesh, Cl-form. Less than 2% loading[2]. 9±1°C. As and Ge in the liquid phase were determined colorimetrically (molybdenum blue method[3] for As and phenylfluorone method[4] for Ge)

This behavior implies that the ready separation of As (V) and P (V) from As (III) and Ge (IV) should be possible. To demonstrate this, first of all, the separation of As (V) and As (III) was tried using 0.93 cm.^{2}×9.0 cm. column of Dowex 2 and adding to it a 12 ml. of sample containing each 0.1 m mol. of As (V) and As (III) in 10 M HCl. As shown in Fig. 2-(A), As (V) appeared rapidly in the effluent in 10 M HCl and then all the As (III) was removed with 1 M HCl. The same technique was found to be applicable to the separation

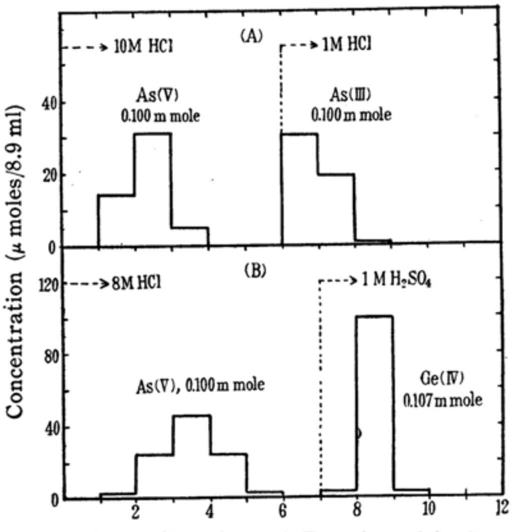

Fig. 2-(A) Separation of As (V) and As (III) Dowex 2-X 8, 80-120 mesh, Cl-form, 0.93 cm^2×9.0 cm. Flow rate, 0.7 ml/min. As (V) and As (III) were determined iodometrically[5].

(B) Separation of As (V) and Ge (IV) Dowex 1-X 8, 80-120 mesh, Cl-form, 0.92 cm^2×13 cm. Flow rate, 1.0 ml/min. Ge (IV) was deternined by iodometry[6].

of P (V) and As (III) and to As (V) and Ge (IV). However, it was observed that if the HCl-concentration of Ge-containing sample exceeds 9 M, the quantitative removal of the element could not be achieved, which is presumably due to the irreversible precipitation of Ge (IV) in concentrated HCl. Detailed experiments revealed that the use of 8 M HCl sample was effective for the complete elution of Ge (IV) with dilute HCl or H_2SO_4. A typical run of the separation of As (V) and Ge (IV) was illustrated in Fig. 2-(B).

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1) H. Kakihana, *Report of Germanium Research Committee of Japan*, No. 15 (1954).

2) See, for example, K.A. Kraus et al., *J. Phys. Chem.*, 58, 11 (1954).

3) Y. Kakida, *Sci. Rep. Research Inst.*, Tohoku Univ., A-1, 399 (1949).

4) H.J. Cluley, *Analyst*, 76, 523 (1951).

5) J.T. Odencrantz and W. Rieman III, *Anal. Chem.*, 22, 1066 (1950); Y. Yoshino, This Bulletin, 24, 39 (1950).

6) B. N. Ivanov-Emin, *Zavod. Lab.*, 13, 161 (1947); *C.A.*, 42, 480 (1948); D.A. Everest, *J. Chem. Soc.*, 1670 (1952), 4117 (1953).

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