SHORT COMMUNICATIONS

On the Electromigration in Ion-exchange Papers

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In electromigration of ions in ion-exchange papers, which are filter papers impregnated with pulverized ion-exchange resins, we may expect the contribution of ion-exchange adsorption to the electromigration behavior of ions. This behavior of alkaline earth metal ions and amino acid ions will be presented in this communication. This may be the first report dealing with the electrophoretic method using these papers, although some chromatographic experiments have been carried out[1].

The usual apparatus for paper electrophoresis (Toyo Roshi Type C) were used and the ionic mobilities under constant voltages were measured. Ion-exchange papers (Rohm and Haas Co.) were Amberlite SA-2 (sulfonic) and WA-2 (carboxylic), which were used after conditioning with acid, alkali and methanol. For comparison, Toyo Roshi No. 50 was used as an ordinary paper. Systems examined are Mg^{2+}, Ca^{2+}, Sr^{2+} and Ba^{2+} (chloride) supported in 0.05 N hydrochloric acid, sodium chloride or sodium hydroxide, and glycine, glutamic acid and lysine monohydrochloride supported in acetic acid-sodium acetate. For detection of spots of ions, coloration of alkaline earth metal with alizarin-ammonia and that of amino acid with ninhidrin were adopted.

TABLE I. MOBILITIES OF ALKALINE EARTH METAL IONS
10 V./cm., supporting media 0.05 N HCl

	Mobilities, $cm^2/V.\ sec. \times 10^4$			
	Mg^{2+}	Ca^{2+}	Sr^{2+}	Ba^{2+}
Toyo Roshi No. 50	3.1	3.6	3.6	3.9
Amberlite SA-2	0.22	0.33	0.33	0.03
Amberlite WA-2	2.6	3.0	3.0	3.3

TABLE II. MOBILITIES OF AMINO ACID IONS
25 V./cm., supporting media 1 M CH_3COOH

	Mobilities, $cm^2/V.\ sec. \times 10^4$		
	Glycine	Glutamic acid	Lysine
Toyo Roshi No. 50	0.71	0.53	1.27
Amberlite SA-2	0.11	0.09	0.01
Amberlite WA-2	0.66	0.45	0.81

A part of the experimental results is shown in Tables I and II. The ionic electromigration in ion-exchange papers possesses the diminished velocity and tailing, in comparison with the case where the ordinary paper is used. This is remarkable on SA-2 paper which exhibits strong exchange adsorption for cations. It must be noticed that the ionic mobilities decrease in the same order, $Ba^{2+} > Sr^{2+}$, $Ca^{2+} > Mg^{2+}$, on the paper No. 50 as in free solution, but Sr^{2+}, $Ca^{2+} > Mg^{2+} > Ba^{2+}$ on sulfonic SA-2 paper in acidic medium*. This might be ascribed to especially strong affinity of sulfonic acid resin for barium ion, being in accordance with observation in the permselectivity of the ion-selective membrane[2]. On carboxylic WA-2 paper, there is scarecely adsorption effect in acidic medium, where the paper is not in dissociated state. In neutral and alkaline medium, the ionic mobilities have the order, $Ba^{2+} > Sr^{2+} > Mg^{2+} > Ca^{2+}$, e. g., calcium ion is retarded to a great extent. Amino acid ions in acidic medium decrease in migrating velocity on SA-2 (lysine most remarkable), but do not decrease largely on WA-2 which does not dissociate so that the adsorption effect is small.

From the above observation, it was confirmed that the synergetic effect of electromigration and ion-exchange adsorption exerts, and this method offers the practical application to separation of ions and is interesting in connection with the ionic transport behavior across the ion-exchange membranes.

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1) M. M. Tuckerman, *Anal. Chem.*, **30**, 231 (1958); H. R. Roberts and M. G. Kolor, ibid., **31**, 565 (1959); H. T. Peterson, Jr., ibid., **31**, 1279 (1959).

* In neutral and alkaline medium the similar results are obtained but calcium ion is retarded to some extent.

2) T. Yamabe, M. Senō, T. Tanaka and I. Kamii., This Bulletin, **33**, 1740 (1960).