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NOTE

Kinetic Study of Ion Exchange by Radiotracer Technique Using an Anion Exchange Resin

R.S. LOKHANDE* and ABHIJIT B. PATIL
Department of Chemistry, University of Mumbai
Vidyanagari, Kalina, Santacruz (East)
Mumbai-400 098, India

The study deals with use of tracers to find out the exchange rate of an ion exchange resin which is measured on a γ ray spectrometer. Radiotracers can be used to detect small concentration, leakage flow and diffused rate. In industries it is a convenient and sensitive analytical tool.

Ion exchange is a reversible process in which dissolved ionic species are taken up by a solid and stoichiometrically replaced by an equivalent amount of another ionic species of the same sign[1]. Ion exchange phenomenon was first noticed by Thompson and Way.[2, 3]

In the present study radioactive iodine-131 is used as a tracer to find out rate of exchange on 830 (Type-1).

830 (Type-1) is a strongly basic anion exchanger having a size of 0.3–1.2 mm. The resin supplied by the manufacturer was initially in chloride form. Further it was conditioned and converted into iodide form before use.

The conditioned resin is used for the study of two series of experiments.

A. The effect of amount of resin on the kinetics of exchange.

B. The effect of iodide ion concentration.

In the first set of experiments the amounts of resin are varied from 1–4 g. 200 mL of potassium iodide is labelled with radioactive iodine *i.e.*, the tracer I. 1 g of resin is added in the solution with constant stirring at 25°C in a thermostat. 1 mL aliquot at an interval of every minute is taken in a dry test tube and activity is measured. This is continued for $\frac{1}{2}$ h and further for an infinite time. In the second set of experiments the concentration is changed from 0.005 to 0.02 m keeping the procedure similar.

Many interesting features are observed from the present investigation. The results obtained are tabulated in Tables 1–3. Specific reaction rate remains almost same at 25°C for the change in concentration (0.005–0.02 M) as shown in Table-1. But as the temperature increases there is a gradual increase in specific reaction rate. However, there is a drastic change in the specific reaction rate, when the amount of resin is increased from 1–4 g (Table-3). It is seen from the present

study that the tracer technique may be used in ion exchange chomatography. This also indicates that it can increase the capacity of exchange of similar ions in the exchanger.

TABLE-1
EFFECT OF CONCENTRATION ON ION EXCHANGE RESIN

Volume of iodide ion solution = 200 mL, Temp. = 25°C
Amount of ion exchange resin = 1 g

Concentration of iodide ion solution	Specific reaction rate	Millimoles of iodide ion solution	Amount of iodine ion exchange millimoles	Initial rate of exchange millimoles
0.005 M	0.106	1	0.528	0.055
0.010 M	0.104	2	1.075	0.112
0.020 M	0.108	4	2.208	0.238

TABLE-2
EFFECT OF TEMPERATURE ON ION EXCHANGE RESIN

Concentration of iodide ion solution = 0.005 M
Amount of ion exchange resin = 1 g

Temperature (°C)	25	30	40
Specific reaction rate	0.106	0.133	0.166

TABLE-3
EFFECT OF AMOUNT OF RESIN ON EXCHANGE REACTION

Concentration of iodide solution = 0.005 M, Temp. = 25°C
Amount of iodine ion in 200 mL solution = 1 millimole

Amount of resin in g	Specific reaction rate	Amount of iodide ion exchange millimoles	Initial rate of ion exchange millimoles
1	0.06	0.528	0.055
2	0.15	0.594	0.068
3	0.203	0.678	0.138
4	0.247	0.737	0.182

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