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NOTE

Effects of Temperature and Amount of Ion Exchange Resin on Ion Exchange Reaction Rate

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The kinetics of ion exchange reaction has been studied by the application of ^{131}I as a tracer isotopes. The exchange rate of ion exchange resin Duolite A-116 have been determined. Kinetics of ion exchange at different temperature ranging from 25 to 45ºC and particularly at low concentration of eletrolyte (KI) ranging from 0.0025 to 0.04 M and for different amount of ion exchange resin ranging from 0.25 to 2.0 g has been carried out.

Key Words: Exchange, Radioactive, Iodide ion, Duolite A-116, Resin.

The knowledge of important physical and chemical properties of ion exchange is a complementary part of resin characterization study. The property that involves stability of an ion exchange is of great significance in most instances and it generally decides the selection of an exchanger for any particular exchange process. Ion exchange resin have many application in scientific research and industries due to their mechanical, thermal and exchange properties[1,2].

A number of investigations carried out equilibrium studies extending over a wide range of composition of solution and resin[3-5]. Regarding the utilization of ion exchange resins for industrial purpose the first attempt was made by Gans[6] for softening of water and also for de-colourizing sugar solution. The advantage of ion exchange method is that work is less time consuming and simple and in many separation higher accuracy is obtained[7].

The present investigation is a part of effort for evaluating the kinetic of exchange between iodide ions in solution and radioactive iodide ions in ion exchange resin Duolite A-116 which is strongly basic anion exchanger.

Duolite A-116, which is supplied by the manufacturers in the chloride form was converted into iodide form using 10 % KI solution in a conditioning column. The conditioned resins were then air dried and used for further study. For this study ^{131}I was effectively used as tracer isotope which was obtained from Board of Radiation and Isotope Technology (BRIT) Mumbai. KI solution of different concentrations were labeled, such that

1.0 mL of this labeled solution will have known activity between 10,000 to 11,000 counts/min as measured on X-ray spectrometer. To these solution of different concentrations of known initial activity (cpm), fixed amount of ion exchange resin (0.5 g) in iodide form were added and under continuous stirring of the solution, the activity of 1 mL solution was measured an interval of every 3 min. Due to rapid exchange of radioactive iodide ions in solution with iodide ions on ion exchange resins, the activity of 1 mL solution decreases rapidly for an interval of time but after some time it decreases slowly. The decrease in activity (cpm) will correspond to the activity on the resin surface. This experiment is repeated at various temperatures ranging from 25 to 45ºC. The temperature of the solution is maintained accurately with deviation of ± 0.1ºC by using surf water bath.

As the temperature of KI solution increases, the rate of reaction due to increase in temperature (Table-1) the collisions between radioactive iodide ions in solution and iodide ions in ion exchanger increases. But the increase in reaction rate is more pronounced which is due to increase in number of exchangeable iodide ions on ion exchange resin[8] (Table-2).

TABLE-1
EFFECT OF TEMPERATURE ON ION EXCHANGE REACTION
Concentration of KI : 0.01M; Amount of ion exchange resin : 0.5 g

Temperature (ºC)	25	30	35	40	45
Specific reaction rate (min^{-1})	0.0980	0.1095	0.1200	0.1300	0.1395

TABLE-2
EFFECT OF AMOUNT OF ION EXCHANGE RESIN ON ION EXCHANGE REACTION RATES
Concentration of labeled iodide ion solution : 0.01 M; Temperature : 25ºC

Amount of ion exchange resin (g)	0.250	0.500	0.750	1.000	1.250	2.000
Specific reaction rate (min^{-1})	0.081	0.098	0.109	0.126	0.142	0.189

REFERENCES

1. K. Dorfer, Ion Exchangers, Water de Gruyter, Berlin (1991).
2. A. Clearfield, Inorganic Ion Exchange Materials, CRC Press, Boca Raton (1987).
3. S. Hiroshi and Y. Tabata, *Bull. Chem. Soc. (Japan)*, **29**, 527 (1956).
4. G. Dickel, *Z. Phys. Chem.*, **25**, 233 (1960).
5. E. Gluekaulf, *Proc. Roy. Soc. (London)*, **214A**, 207 (1952).
6. R. Gans, *Center Mineral Geo.*, **22**, 728 (1913).
7. J.L. Eisenmann and J.D. Smith, Report 228108, U.S. National Technical Information Services, Springfield VA (1973); *Chem. Abstr.*, **81**, 4110b (1974).
8. R.S. Lokhande and P.U. Singare, *Samayak J. Chem.*, **3**, 24 (1999).

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