RADIOTRACER STUDIES IN CARRYING OF COBALT(II) AND ZINC(II) ON SELECTED SOLIDS

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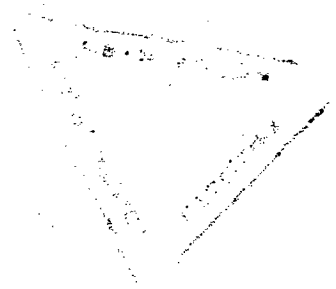

C E R T I F I C A T E

This is to certify that the thesis entitled, "Radiotracer Studies in Carrying of Cobalt(II) and Zinc(II) on Selected Solids" being submitted by Mr. Hemant Kumar Purohit to the Indian Institute of Technology, Delhi for the award of the degree of 'Doctor of Philoscphy', is a record of bonafide research work carried out by him. Mr. Hemant Kumar Purohit has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis, which to my knowledge, has reached the requisite standard.

The results contained in thesis have not been submitted in part or in full, to any other University or Institution for the award of any degree or diploma.

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A C K N O W L E D G E M E N T S

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(HEMANT KUMAR PUROHIT)

A B S T R A C T

The thesis embodies the results of an investigation on the carrying of Cobalt(II) and Zinc(II) on Sulphates of Lead, Barium and Strontium, using the radioisotopes as indicators.

A brief investigation on carrying of chromate species has also been made using chromates of lead and barium and oxides of aluminum, chromium and iron.

The thesis is presented in four parts:

Part I comprises of an introduction including resume of the work done by earlier workers having a bearing on the present investigation, scope and object of the preseht work and the description of the materials and methods used for the experimental work.

Part II is devoted to the study of carrying of tagged cobalt(II) and zinc(II) ions by the preformed carriers. The deposition study involves an examination of the influence of pH, in the presence as well as in absence of certain added lattice and nonlattice ions. In addition, the influence of these lattice as well as nonlattice ions on the course of instantaneous carrying of the tracer, has also been investigated. Study of the influence of the time of ageing of the different freshly made carriers on carrying of tracers and also of the time of contact of the radioactive tracers with the fresh as well as ignited adsorbents has been carried out.

The experimental data reveal that observed carrying of the tracer ions i.e., cobalt(II) and zinc(II), is very much dependent upon the pH of the aqueous medium. pH plays a dominant role in the adsorption of these tracers. The fraction of the $^{60}Co(II)$ and $^{65}Zn(II)$ carried increases generally with increase in pH and reaches a maximum value. At higher pH, hydrolysis of the tracer ions plays an important role in the carrying of these tracers.

The instantaneous carrying of the cobalt(II) and zinc(II) tracers is significantly helped in the presence of certain nonlattice anions such as phosphates and arsenates. The carrying is also influenced favourably by the time of contact of the tracer ions in solution with the carrier surface, under varied experimental conditions.

In the case of freshly made surfaces, the instantaneous carrying at fixed pH value, falls with the ageing of the precipitate at room temperature. The ageing is effectively enhanced if the maturing of carrier is done at higher temperature.

The experimental results obtained in the investigation have been interpreted with a view to arrive at the mechanism of the carrying, probable nature of the carried entity and lastly the location of the carried tracer in the body of the carrier. Efforts have been made to explain the results in terms of counter ion exchange mechanism as well as hydrolysis

of the tracer ions. Carrying is postulated to be due to the surface precipitation of the tracer ions on preformed surfaces. At lower pH, mode of adsorption is postulated to be due to counter ion exchange mechanism whereas at higher pH hydrolysis of tracer ion is mainly responsible for carrying.

Part III includes a brief study in the carrying of $^{51}CrO_4^{2-}$ tracer on preformed lead chromate, barium chromate, iron oxide, aluminium oxide and chromium oxide. Influence of pH in the presence as well as in absence of different added ions have been examined.

Finally in Part IV, a radioactive indicator study has been attempted to examine in the feasibility of concentrating the microgram quantities of Co(II) and Zn(II) species from extremely dilute solutions by subsequent desorption of the activity carried under optimum conditions in the light of the above studies. The findings may also fine some applications in problems of disposal of radioactive waste at low concentration level.

C O N T E N T S