RADIOCHEMICAL STUDIES ON ADSORPTION BEHAVIOUR OF CHROMIUM (VI) ON CERTAIN METAL OXIDES

by

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DEDICATED

TO MY

MOTHER

CERTIFICATE

This is to certify that the thesis entitled, **"RADIOCHEMICAL STUDIES ON ADSORPTION BEHAVIOUR OF CHROMIUM(VI) ON CERTAIN METAL OXIDES"** being submitted by Ajit Kumar Mitra to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy in Chemistry, is a record of bonafide research work carried out by him. Mr. Mitra 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 this dissertation have not been submitted, in part or in full, to any other University or Institute for the award of any degree or diploma.

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Amitra

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Abstract

The existence of heavy metals in radioactive waste in aquatic environments has led to much concern over their influence on plant and animal life in these environments and indeed on man's need for wholesome water. Technological advances have greatly increased the use of many metallic elements and increasing amounts of these elements are finding their way into the hydrosphere, and augmenting the 'natural' concentrations. The accumulation of these elements, many of which are highly toxic to animal life, by aquatic plant life and the lower forms of marine animals, is one of man's less praiseworthy influences on the biosphere.

Radioactive wastes are produced wherever radioactive materials are processed or used. The waste is characteristic of the process from which it is derived and may be in a gaseous, liquid or solid form. Special attention may have to be given to waste prior to their release to prevent any injurious effects on public health. Adsorption of chromate ions on manganese dioxide, stannic oxide and vanadium pentaoxide have been investigated at different pH. The findings are explained in the light of deprotonation/hydroxyl ion association reaction on oxide surface and its subsequent interaction with the tracer. The variation in the results is further explained in terms of postulated surface deposition of compounds having low

solubility and dissociability. The lattice as well as non-lattice cations and anions which form soluble complexes with metal ions can either increase or decrease metal adsorption. The infrared spectroscopy has been used to show the existence of chemical interaction between chromate ions and the surface of the hydrous oxide.

The kinetics of adsorption as well as desorption have been studied at different concentrations and temperatures. The kinetic process for both adsorption as well as desorption follows essentially the first order kinetics. A significantly higher value of activation energy for desorption process suggests that the adsorption of chromate ions is more feasible than the desorption process in aqueous solutions under the prevailing experimental conditions.

A radioactive indicator study has also been attempted to examine the feasibility of concentrating the microgram quantity of chromate ions from extremely dilute solutions by subsequent desorption of the activity carried under the optimum conditions. These findings may also find some suitable applications in connection with the problems dealing with the disposal of radioactive waste at low concentration level.

CONTENTS

CHAPTER - V