

Study Of Decontamination And Separation Of Some Radioactive Nuclei By Natural Materials

A Thesis submitted

By

Hanan Hussien Sameda
B. Sc and M. Sc in Chemistry

Nuclear Chemistry Department
Hot Laboratories Center
Atomic Energy Authority

For

The Degree of Doctor of Philosophy of Science
(CHEMISTRY)

To

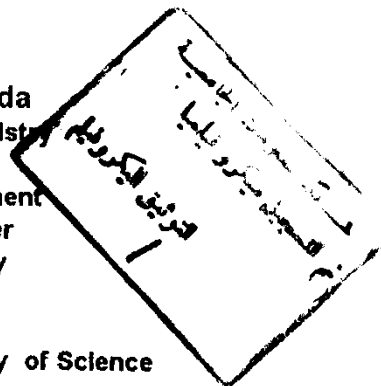
Chemistry Department ; Faculty of Science
Ain Shams University
1996

SUPERVISED BY

Prof. Dr. M.F El-Shahat
Prof. of Analytical and
Inorganic Chemistry
Faculty of Science
Ain Shams University

Prof Dr. H.A.El-Naggar
Head of Nuclear Chemistry
Department - Hot Labs.Center
Atomic Energy Authority

Dr. N.A. Belacy
Assist. Prof. of Physical Chemistry
Hot Labs. Center
Atomic Energy Authority



541.38
H. H

6/6/92



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

" قالوا سبحانك لا علم لنا إلا ما علمتنا
إنك أنت العليم الحكيم "

صدق الله العظيم

سورة البقرة

آية رقم (٣٢)

**Study of Decontamination and Separation of Some
Radioactive Nuclei by Natural Materials**

Advisors

Prof. Dr . M.F. El- Shahat
Prof.Dr. H.A. EL- Naggar
Prof.Dr. N. A. Belacy

Approved

El-Shahat
H.A. Naggar
Belacy

A.F.M. Fahmy

Prof DR.F. M. Fahmy
Head of Chemistry Department
Faculty of Science
Ain Shams University



ACKNOWLEDGEMENT

I would like to express my deep gratitude to Prof.Dr. M.F. El-Shahat Prof. of Inorganic and Analytical Chemistry, Faculty of Science, Ain Shams University for sponsoring this work and fruitful discussion.

I would like to express my deep thanks and gratitude to Prof. H.A.El-Naggar, Head of the Nuclear Chemistry Dept., Hot Labs. Center, Atomic Energy Authority for his supervision, interesting discussions and continuous help during all the stages of the development of the work.

I would like to express my sincere thanks and deep gratitude to Ass. Prof. N.Belacy, Hot Labs Center, Atomic Energy Authority, for suggesting the point, supervision, continuous follow up of the experimental work, interesting discussion and constructive criticism of the manuscript, I would like to express my sincere appreciation to Ass.Prof. M.K.Shehata, for his interest, encouragement, and valuable revision of the manuscript.

Finally I would like to express my deep thanks to my colleagues in the Nuclear Chemistry Department, Hot Labs. Center for their help and support.

ACKNOWLEDGMENT

CONTENTS

LIST OF TABLES	(I)
LIST OF FIGURES	(I)
ABSTRACT	(VI)
CHAPTER I INTRODUCTION	(1 - 24)
CHAPTER II EXPERIMENTAL	(25 - 30)
CHAPTER III	(31 - 131)
PART I RESULTS AND ANALYSIS.....	(31 - 126)
PART II DISCUSSION AND CONCLUSION	(127 - 131)
SUMMARY	(132 - 134)
REFERENCES	(135 - 143)
ARABIC SUMMARY	

Chapter I Introduction

Page

I.1. General	1
I.2. Natural exchangers	1
I.2.1. Zeolites	2
I.2.2. Clay	2
I.2.3. Humous substances	3
I.2.4. Wood	4
I.2.4.1. Wood resources	4
I.2.4.2. Uses of wood and wood products	5
I.2.4.3. Formation of wood cells	5
I.2.4.4. Physical properties of wood	6
I.2.4.4.1. Specific weight	6
I.2.4.4.2. Moisture content	6
I.2.4.4.3. Specific heat	7
I.2.4.5. Chemistry of wood	7
I.2.4.5.1. Cellulose	7
I.2.4.5.2. Hemicellulose	8
I.2.4.5.3. Lignin	9
I.2.4.5.4. Extractive components	9
I.2.4.5.4.1. Inorganics	10
I.2.5. Applications of cellulose in separation techniques	10
I.3. About the chemistry of the used elements	11
I.3.1. Uranium	11
I.3.1.1. Occurrence	11
I.3.1.2. Chemical properties	11
I.3.1.3. Importance of uranium	12
I.3.2. Americium	13
I.3.2.1. Occurrence	13
I.3.2.2. Chemistry of americium	13
I.3.2.3. Uses of americium	13
I.3.3. Europium	14
I.3.3.1. Occurrence	14
	14

	14
	15
I.3.3.2. Chemistry of europium	15
I.3.3.3. Uses of europium	15
I.3.4. Cobalt	15
I.3.4.1. Occurrence	15
I.3.4.2. Chemistry of cobalt	16
I.3.4.3. Uses of cobalt	16
I.3.5. Zirconium	16
I.3.5.1. Occurrence	16
I.3.5.2. Chemistry of zirconium	16
I.3.5.3. Uses of zirconium	16
I.3.6. Cesium	17
I.3.6.1. Occurrence, chemistry and uses	17
I.4. Adsorption phenomena	17
I.4.1. Types of adsorption	18
I.4.1.1. Physical adsorption	18
I.4.1.2. Chemical adsorption	18
I.4.1.3. Electrostatic adsorption	18
I.4.2. Trace elements adsorption	19
I.4.2.1. Adsorption of simple trace ions	19
I.4.2.2. Adsorption of cations	19
I.4.2.3. Adsorption of anions	19
I.4.2.4. Adsorption of complex cations	20
I.4.2.5. Adsorption of neutral molecules	20
I.4.2.6. Adsorption of trace colloids	20
I.4.3. Main factors affecting adsorption of radioactive elements	20
I.4.3.1. Nature of adsorbent	20
I.4.3.1.1. Surface area	21
I.4.3.1.2. Chemistry of surface	21
I.4.3.2. Nature of adsorbate	21
I.4.3.3. Hydrogen ion concentration	21
I.4.3.4. Effect of contact time	22
I.4.3.5. Effect of temperature	22
I.4.4. Adsorption isotherms	22
I.4.4.1. Langmiur adsorption isotherm	23
I.4.4.2. Freundlich isotherm	24
I.4.5. Desorption phenomena	