(Validation of Radiochemical Separation for Uranium Assay in Different Matrices)

Presented by

Ahmad Rabie El shahat Agha

Assistanat Lecturer

Nuclear and Radiological Regulatory Authority

A Dissertation Submitted for the Philosophy Doctor (Ph.D) degree of science in (Inorganic Chemistry)

THESIS ADVISORS

Prof. Dr. Ebtissam Ahmed Saad

Professor of Inorganic Chemistry

Faculty of Science

Ain Shams University

Prof. Dr. Sayed Ali Elmongy

Professor of Radioactive Measurements

Nuclear and Radiological Regulatory Authority

2017

Approval Sheet

"Validation of Radiochemical Separation for Uranium Assay in Different Matrices"

By

Ahmad Rabie El Shahaat Agha

has been reviewed and approved by the following

THESIS ADVISORS **Approval**

Prof. Dr. Ebtisaam Ahmed Saad

Professor of In Organic Chemistry,

Faculty of Science, Ain Shams University .

Prof. Dr. Sayed Ali Elmongy

Professor of Radioactive measurements ,

Nuclear and Radiological Regulatory Authorit

Head of chemistry Department

Prof. Dr. Ibrahim H.A. Badr

To

My LIFE, THE GREATEST LOVE
(Egypt)

TO

Those who gone away from us to the real life

My great Father

My great Mother

(May Allah have mercy on them)

Acknowledgment

Above all and first of all, All gratitude is due to almighty **ALLAH**, by his grace and care, the completion of this work was possible, and I hope this work will be helpful.

The author is greatly indebted to **Prof. Dr. Ebtissam Ahmed Saad,** Prof. of Inorganic Chemistry, Chemistry Department, Ain shams University, for her science supervision, continuous guidance, valuable advice, and reviewing.

The author is greatly gratitude to **Prof. Dr. Sayed Ali El-Mongy**, (NRRA) , for his supervision, continuous guidance, reviewing, the revision scientific help, and valuable advice.

***Words are not enough to thank my Spiritual father**

(Prof. Dr. Kariem El- Adham) for all things .

The author‘s thanks are due to all persons who extended measurable cooperation for the implementation of this work and all my colleagues in Nuclear Fuel cycle Department Specially the head of the department **Prof. Dr. M. Abd El-geliel** .

* Special thanks are given to my dear friends :

Dr. Sameh shaban , Dr. Waleed fekry , Dr. Mohamed El-Keshawy and Dr. Mohamed El-Saied for their kind cooperation .

Ahmad Rabie Agha

Contents

Chapter 2: EXPERIMENTAL

List of figures

List of tables

Abstract

Uranium is the fuel for about 1000 nuclear reactors of various kinds that exist in the world. These reactors produce electricity, nuclear and thermo nuclear weapons, In addition to the natural uranium, uranium is discharged into the environment due to mining activities, using special military weapons and liquid and gaseous effluents from nuclear facilities.

In the radiochemical equilibrium, it consists of the isotopes ^{234}U, ^{235}U and ^{238}U with the natural activity ratio of 1:0.0462:1, corresponding to amass ratio of 0.0054:0.711:99.2836 percent.

All of these three nuclides are alpha-emitters. From nuclear facilities, additional amounts of uranium are discharged into the environment. In effluents from nuclear facilities ,the ratios of uranium isotopes differ very much .To be able to compare them with that from natural background,

Study of natural radiation background and exposure of human beings are of great importance, not only for practical reasons but also for radiological impact of nuclear activities , It is necessary to determine the baseline of natural radiation and radioactivity so as to distinguish man- made contamination in time and take appropriate measures to protect the environment. Secondly, the accumulation of information on natural radiation is of great value for drawing up rules and regulations on radiation protection standards. Thirdly, natural radiation is the source of exposure of human being: studies of the dose from natural radiation and its effects on health could advance

the understanding of radiation damage. Lastly, some natural radionuclides are trace elements, which play important roles in the fields of meteorology, hydrology, geology and astronomy

The main objective of the present study is to determine the uranium isotopes ^{234}U, ^{235}U,^{238}U in the different samples matrices in the environment by using destructive assay alpha spectrometry and non destructive assay gamma spectrometry.

1. INTRODUCTION

1.1 Introduction

An increasing interest has been shown in the actinide elements analysis since World War II, the determination of natural and artificial actinide isotopes is of great interest because of the potential impact of these elements on the public health, environmental and safeguards. (uranium especially).

The fallout due to weapon testes in the mid of this century, nuclear reactors effluents, planes, ships, transporting nuclear materials, satellites effluent discharges from nuclear facilities e. g uranium reprocessing plants and plutonium handling facilities, are potential sources of these isotopes.

Many radiochemical procedures for actinide determination are described, but only few of them are suitable for different types of environmental samples to be measured by destructive assy. This can be achieved by alpha spectrometry assay or by other techniques after chemical preparation of actinides, Accurate conclusions