Ain Shams University
Faculty of Science

CHEMICAL STUDIES ON POLYANILINE TITANOTUNGSTATE AS A NEW COMPOSITE CATION EXCHANGER AND ITS ANALYTICAL APPLICATIONS FOR REMOVAL OF CESIUM FROM AQUEOUS SOLUTIONS

A PhD Thesis Submitted

To

Chemistry Department
Faculty of Science
Ain Shams University

By

MAGDY KHALIL MOHAMED IBRAHIM
M. Sc. (**Inorganic Chemistry**)
Department of Nuclear Fuel Technology
Hot Laboratories Center
Atomic Energy Authority

2012

CHEMICAL STUDIES ON POLYANILINE TITANOTUNGSTATE AS A NEW COMPOSITE CATION EXCHANGER AND ITS ANALYTICAL APPLICATIONS FOR REMOVAL OF CESIUM FROM AQUEOUS SOLUTIONS

A PhD Thesis Submitted
To

Chemistry Department
Faculty of Science - Ain Shams University

For
Degree doctor of philosophy of science (Chemistry)

By

MAGDY KHALIL MOHAMED IBRAHIM
M. Sc. (**Chemistry**)
Department of Nuclear Fuel Technology
Hot Laboratories Center
Atomic Energy Authority

Supervised By

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

Prof. Dr. I. M. El-Naggar
Prof. of Physical Chemistry
Hot Laboratories Centre
Atomic Energy Authority

Prof. Dr. E. S. Zakaria
Prof. of Physical Chemistry
Hot Laboratories Centre
Atomic Energy Authority

Prof. Dr. I. M. Ali
Prof. of Physical Chemistry
Hot Laboratories Centre
Atomic Energy Authority

2012

A Thesis Title

CHEMICAL STUDIES ON POLYANILINE TITANOTUNGSTATE AS A NEW COMPOSITE CATION EXCHANGER AND ITS ANALYTICAL APPLICATIONS FOR REMOVAL OF CESIUM FROM AQUEOUS SOLUTIONS

A thesis Submitted By

MAGDY KHALIL MOHAMED IBRAHIM

M.Sc. (Inorganic Chemistry)

This thesis has been approved for submission by supervisors

Thesis Advisors: **Signature**

1- Prof. Dr. M. F. El-Shahat   ……………...

   Prof. of Analytical and Inorganic Chemistry

   Ain Shams University

2- Prof. Dr. I. M. El-Naggar   ……………...

   Prof. of Physical Chemistry

   Atomic Energy Authority

3- Prof. Dr. E. S. Zakaria   ……………...

   Prof. of Physical Chemistry

   Atomic Energy Authority

4- Prof. Dr. I. M. Ali   ……………...

   Prof. of Physical Chemistry

   Atomic Energy Authority

Credit
Head of the Department of Chemistry

Prof. Dr. Maged S. Antanious

ACKNOWLEDGEMENT

بِسْمِ اللهِ الرَّحْمَنِ الرَّحِيمِ

قُلْ إِنَّ صَلَاتِي وَنُسُكِي وَمَحْيَايَ وَمَمَاتِي لِلَّهِ رَبِّ الْعَالَمِينَ

صَدَقَ اللهُ الْعَظِيمُ

CONTENTS

CHAPTER-1
INTRODUCTION

CONTENTS

CHAPTER-2
MATERIALS AND METHODS

CHAPTER-3
RESULTS AND DISCUSSION

LIST of TABLES

CONTENTS

LIST of FIGURES

Chemical Studies on Polyaniline Titanotungstate as a New Composite Cation Exchanger and Its Analytical Applications for Removal of Cesium from Aqueous Solutions

List of Publications

1. I.M. El-Naggar, E.S. Zakaria, I.M. Ali, M. Khalil, M.F. El-Shahat, Kinetic modeling analysis for the removal of cesium ions from aqueous solutions using polyaniline titanotungstate, Arabian Journal of Chemistry (2012) 5, 109–119.

2. I.M. El-Naggar, E.S. Zakaria, I.M. Ali, M. Khalil, M.F. El-Shahat, Chemical studies on polyaniline titanotungstate and its uses to reduction cesium from solutions and polluted milk, Journal of Environmental Radioactivity (2012) 112, 108-117.

Aim of Work

The latest developments of synthetic ion exchangers are the preparation and the application of inorganic-organic composite ion exchangers in order to obtain a combination of the advantages of inorganic and organic ion exchangers. These materials are used in analytical chemistry and in separation technology, because of their high selectivity's for metal ions and ease of preparation. Many inorganic-organic composite ion exchangers have been developed earlier by incorporation of organic polymers in the inorganic matrix. In order to increase interlayer distance of layered inorganic ion exchangers, to increase the selectivity's for the ions and to prepare larger particles with higher granular strength for column for the treatment of various aqueous solutions and radioactive waste from cesium. This may open new possibilities for their industrial applications. In this concern, efforts have been made to study and develop effective and economic materials for treatment cesium ion from aqueous solutions waste using polyaniline titanotungstate. The following items will be studied:

- Synthesis of polyaniline titanotungestate.
- Characterization of the prepared material using IR, XRD, SEM and DTA-TGA analysis.
- Chemical stability, equilibrium studies and capacities of the prepared material for Cs^+ at different operation conditions.
- Determination of the diffusion mechanisms and selectivity of these materials.
- Ion exchange isotherms.
- Separation of Cs^+ from other ions.