بسم اللّه الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصل

Faculty of Science
Chemistry Department

Preparation and Characterization of Modified Nano-Materials for Preconcentration and Determination of Some Elements of Nuclear Interest

A Thesis Submitted

By

Moubarak Abdel-Raheem Sayed Marzouk.
Assistant Lecturer,
Nuclear Fuel Chemistry Department,
Hot Laboratories Center,
Atomic Energy Authority.
(M.Sc. in Chemistry 2016)

To

Chemistry Department, Faculty of Science,
Ain-Shams University

For

The Degree of Doctor of Philosophy (Chemistry)

2020

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Thesis supervisors

Prof. Dr. Saad Abdelwahab Mohamed
Prof. of Physical Chemistry
Faculty of Science – Ain Shams University

Prof. Dr. Hisham Fouad Aly
Prof. of Nuclear Chemistry
Former Chairman of Atomic Energy Authority

Prof. Dr. Abd El-Fatah Ibrahim Helal
Prof. of Nuclear Physics,
Former Vice Chairman of Atomic Energy Authority

Hazem Hasan Mahmoud
Associate Prof. of Analytical Chemistry,
Atomic Energy Authority

2020

Faculty of Science
Chemistry Department

APPROVAL SHEET

Title of Ph.D. Thesis:

"Preparation and Characterization of Modified Nano-Materials for Preconcentration and Determination of Some Elements of Nuclear Interest"

Name of the candidate: **Moubarak Abdel-Raheem Sayed Marzouk.**

Thesis supervisors	Approved
Prof. Dr. Saad Abdelwahab Mohamed Prof. of Physical Chemistry, Faculty of Science, Ain-Shams University.	…………………….
Prof. Dr. Hisham Fouad Aly Prof. of Nuclear Chemistry, Ex – Chairman of Atomic Energy Authority.	…………………….
Prof. Dr. Abd El-Fatah Ibrahim Helal Prof. of Nuclear Physics, Ex – Vice Chairman of Atomic Energy Authority.	…………………….
Dr. Hazem Hasan Mahmoud Associate Prof. of Analytical Chemistry, Nuclear Research Center - Atomic Energy Authority.	…………………….

APPROVAL

Prof. Dr. Ayman Ayoub Abdel-Shafi
Head of chemistry department
Faculty of Science - Ain-Shams University

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ORIGINAL PAPER

Sorption and possible preconcentration of europium and gadolinium ions from aqueous solutions by Mn_3O_4 nanoparticles

Moubarak A. Sayed[1,3] · A. I. Helal[1] · S. M. Abdelwahab[2] · H. H. Mahmoud[1,4] · H. F. Aly[3]

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Abstract

Mn_3O_4 nanoparticles were prepared by co-precipitation method. The prepared samples had been characterized to find the compositional, structural, and functional properties, by means of EDX, XRD, and FTIR, respectively. The prepared manganese oxide nanoparticles (Mn_3O_4 NPs) have average crystallite size of 30–35 nm. The effect of different parameters on the uptake of Eu(III) and Gd(III) by Mn_3O_4 nanoparticles such as pH, initial metal concentration, shaking time, and temperature was examined. The shaking time for both adsorption and desorption was found to be 5 h. The sorption capacities at equilibrium with regards to Eu(III) and Gd(III) were 26.8 and 12.6 mg/g, respectively. Kinetically, the sorption of both elements fitted well to pseudo-second-order model. Sorption equilibrium isotherm obeys more favorably the Langmuir isotherm model. Desorption process of Eu(III) and Gd(III) from Mn_3O_4 NPs was highly managed using 2.0 M HNO_3. A preconcentration factor of 70 and 20 was obtained for Gd and Eu, respectively, using 0.1 g of the Mn_3O_4 nanoparticles.

Keywords Mn_3O_4 nanoparticles · Co-precipitation · Crystallite size · Gadolinium · Europium · Preconcentration

Introduction

Gadolinium is usually considered as one of the lanthanide series in the periodic table, and it has a lot of uses in the field of structural components, fluorescent materials, mechanical devices, electronic industry, and nuclear industry (Singha et al. 2014). Gadolinium is frequently found in nature in two alternative types of ores such as bastnasite and monazite (Zamani et al. 2012). In nuclear field, gadolinium is used as a neutron absorber concerning the control level regulations of nuclear reactors (Rufus et al. 2018). Gd-153 isotope is utilized in X-ray fluorescence in addition to osteoporosis screening. Gadolinium is a gamma-emitter including half-life time about 8 months, so it is applicable for medical disciplines (Othersen et al. 2007). As consequence of utilizing radiotracers, they may leak into the encompassing environment causing poisonous impacts such as radioactive contamination. In addition, radiotracers may lead to a great damage to the body organs as a result of direct contact during treatment or in other methods applied to human beings (Singha et al. 2014).

Europium radioisotopes are used as burn-up monitors to assess the performance of reactors fuels (Kazakov et al. 2018). Europium is used in several fields such as material science and electronics. The struggle between growing requirement in a variety of industries and also the restricted amount of Gd(III) and Eu(III) resulted in an excessive growth in the demand for the recovery of both elements. Therefore, the determination, separation, and recovery of Eu(III) and Gd(III) are very critical due to their existence at very trace concentrations (Aghamohammadhasan et al. 2017).

There are many analytical instruments presented for the determination of gadolinium and europium in different industrial, geological, and environmental samples such as

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✉ Moubarak A. Sayed
mom467@usask.ca

1 Central Laboratory for Elemental and Isotopic Analysis, Nuclear Research Centre, Atomic Energy Authority, Inshas, Cairo, Egypt

2 Chemistry Department, Faculty of Science, Ain-shams University, Cairo, Egypt

3 Hot Laboratories Center, Atomic Energy Authority, Inshas, Cairo 13759, Egypt

4 Radioisotope Department, Nuclear Research Center, Atomic Energy Authority, Dokki, Giza 12311, Egypt

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Chapter II: Experimental