

بسم الله الرحمن الرحيم





شبكة المعلومات الجامعية التوثيق الالكتروني والميكرو فيلم



جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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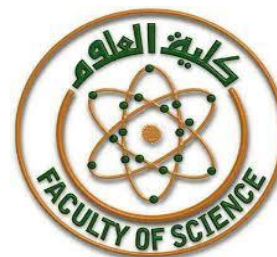
بعض الوثائق الأصلية تالفة





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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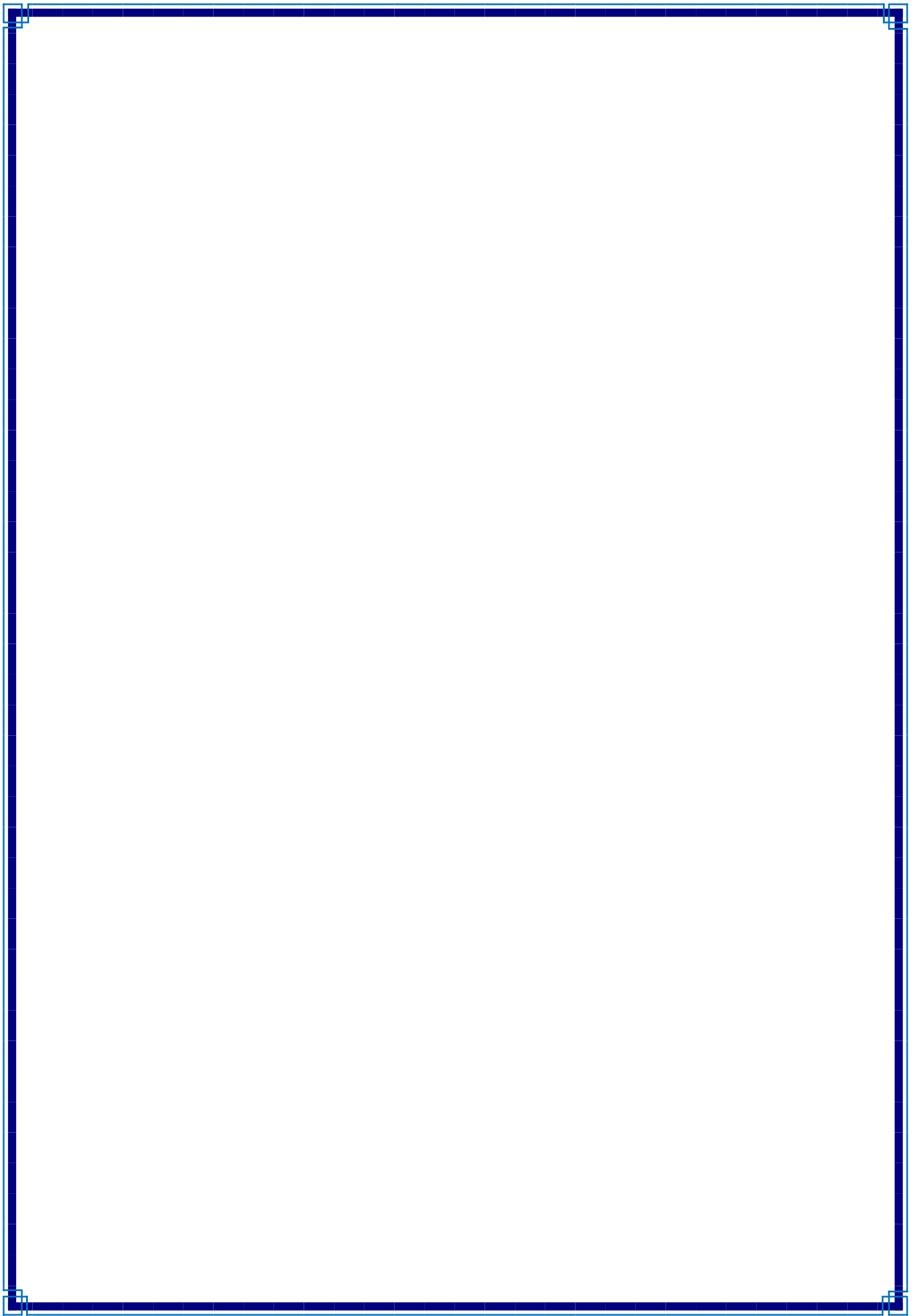
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Moubarak Abdel-Raheem Sayed



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

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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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Contents

List of figures	I
List of tables	XIV
List of abbreviations	XVIII

Chapter 1: Introduction

1. Introduction.....	1
1.1 Rare Earth Elements.....	1
1.1.1 Occurrence of Rare Earth Elements.....	3
1.1.1.1 REEs Occurrences in Egypt.....	3
1.2 Some Aspects on the chemistry of rare earth elements.....	4
1.2.1 General outlines on the Coordination chemistry of REEs.....	6
1.3 Brief account on the properties some REEs of	9
Nuclear interest.....	
1.3.1 Lanthanum.....	9
1.3.1.1 Basic Chemistry.....	9
1.3.1.2 Environmental and health impact.....	10
1.3.1.3 Importance and nuclear Applications.....	10
1.3.1.3 Environmental and health impact.....	10
1.3.2 Europium.....	11
1.3.2.1 Basic Chemistry.....	11
1.3.2.2 Environmental and health impact.....	13
1.3.2.3 Importance and nuclear Applications.....	13
1.3.3 Gadolinium.....	14
1.3.3.1 Basic Chemistry.....	14
1.3.3.2 Environmental and health impact.....	15
1.3.3.3 Importance and nuclear Applications.....	15

1.4 Heavy elements	16
1.4.1 Importance and Toxicity of heavy elements.....	16
1.4.2 Lead as heavy element of nuclear interest.....	17
1.4.2.1 Basic chemistry.....	17
1.4.2.2 Environmental and health impact.....	18
1.4.2.3 Importance and nuclear Applications.....	19
1.5 Methods for determination of the elements under study	19
1.5.1 ICP-OES.....	20
1.5.2 UV-VIS.....	21
1.5.3 NAA.....	22
1.5.3.1 Limitations of NAA.....	23
1.6 Preconcentration of the elements under study	24
1.6.1 Different methods for preconcentration.....	24
1.6.1.1 Ion exchange.....	25
1.6.1.2 Liquid-liquid extraction.....	27
1.6.1.3 Adsorption.....	28
1.6.3.3.1 Types of Adsorption.....	30
1.6.3.3.2 Advantages of adsorption.....	31
1.7 Nanomaterials as sorbent	31
1.7.1 Goethite (α -FeOOH).....	32
1.7.2 Hausmannite (Mn_3O_4).....	34
1.8 Modification of nanomaterials	36
1.8.1 Sodium alginate (SA).....	36
1.8.2 Activated carbon (AC).....	37
1.9 Literature survey	39
1.9.1 Sorption and preconcentration of Lanthanum.....	39
1.9.2 Sorption and preconcentration of Europium.....	41
1.9.3 Sorption and preconcentration of Gadolinium.....	43
1.9.4 Sorption and preconcentration of Lead.....	45
1.10 Aim of the Work	46

Chapter II: Experimental

2.1 Chemicals and Reagents.....	48
2.2 Synthesis.....	49
2.2.1 Synthesis of goethite nanoparticles (NG).....	49
2.2.2 Preparation of sodium alginate@ goethite nanocomposite	50
2.2.3 Synthesis of hausmannite (Mn ₃ O ₄) nanoparticles.....	51
2.2.3.1 Synthesis of activated carbon@ hausmannite nanocomposite.....	53
2.3 Instrumentation.....	54
2.3.1 UV-Visible Spectrophotometric Measurements, UV-Vis	54
2.3.2 Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES).....	55
2.3.3 X-Ray Diffraction (XRD).....	56
2.3.4 Fourier transform infrared spectroscopy (FT-IR).....	57
2.3.5 Thermogravimetric Analysis (TGA- DTA).....	57
2.3.6 Transmission Electron Microscope (TEM).....	57
2.3.7 Field Emission Scanning Electron Microscope (FE- SEM).....	58
2.3.8 N ₂ adsorption–desorption analysis (BET).....	58
2.3.9 Zeta potential measurement (ZPM).....	58
2.3.10 Water swellability.....	58
2.4 Other instruments used in the present work.....	59
2.5 Preparation of main working solutions.....	60
2.5.1 Aqueous Solutions.....	60
2.6 Sorption Investigation.....	60
2.6.1. Batch System.....	60
2.6.2 Factors affecting the adsorption process.....	61
2.6.2.1 Effect of pH	61