



شبكة المعلومات الجامعية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

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



يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار

في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

To be Kept away from Dust in Dry Cool place of
15-25- c and relative humidity 20-40%



شبكة المعلومات الجامعية التوثيق الالكتروني والميكرو فيلم

بعض الوثائق الأصلية تالفة

بالرسالة صفحات لم ترد بالاصل

551

Cairo University
Institute of African Research and Studies
Department of Natural Resources

Recycling Of Some Solid Industrial Wastes In Egypt And South Africa

Thesis

**Submitted in Partial Fulfillment of the
Requirement for the Degree of Master of Science
In African Studies (Mineral Resources)**

By

Ashraf Abd El Hady Abd Alla El Shennawy
B.Sc. (Geology), Ain Shams University 1985

Under supervision of

Prof. Dr. Adel Saad El-hassanin
Prof. and Dean
Institute of African Research
And Studies, Cairo University

Prof. Dr. Mamdoh A.G. Hassan
Ex-chairman and Prof. in Nuclear
Materials Authority

2005

CKC9
CP

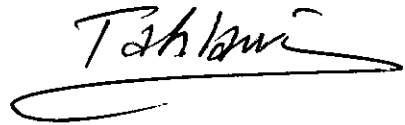
APPROVAL SHEET

NAME : ASHRAF ABD EL HADY ABD ALLA EL SHENNAWY.

**TITLE : RECYCLING OF SOME SOLID INDUSTRIAL WASTES IN
EGYPT AND SOUTH AFRICA**

This Thesis has been approved by :

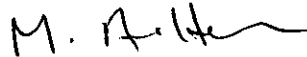
**1-Prof. Mohamed Ragaie EL Tahlawi
Emeritus Professor of Mining Geology
Mining And Metallurgy Department,
Faculty University**



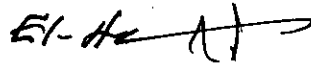
**2-Prof. Mahmoud Abdel Ghani EL Gemmizi
Emeritus Professor of Geology ,
Nuclear Materials Authority .**



**3- Prof. Mamdouh A.G. Hassan
Emeritus Professor of Geology,
Nuclear Materials Authority.**



**4-Prof. Adel Saad EL-Hassanin
Prof. of Soil Sciences and Dean of
The Institute of African Ressearch and studies,
Cairo University**



Date 27/9/2005

TRIBUTE
IN MEMORIAL OF LATE
PROFEESSOR DOCTOR HANI ABDEL MONEIM

The Project of Recycling Industrial Waste was started and headed in the early 1997 by Late Prof. Dr. Hani Abdel Moneim, Head of the Department of Reactors' Materials, Nuclear Materials Authority (NMA) at that time, who established the foundation of this Project. He carried out the preliminary bench-scale experiment to recycle the waste of manufacturing welding rods. He also carried out the first experimental batch of the semi-industrial scale successfully; and he should have been the NMA Supervisor of the present Thesis, but sadly he passed over shortly after. Being one of his devoted students, the Candidate took the main responsibility of the work on the recycling of welding-rod waste, with sincere help of other members of the Project, under the direct supervision of the Chairman of NMA. The least to do in memory of our Professor is to follow up his track, and complete what he successfully started.

ACKNOWLEDGMENTS

It is my great pleasure and privilege to express my sincere thanks and great appreciation to the most distinguished Prof. Dr. A.S. El-Hassanein, Dean of the Institute of African Researches and Studies, Cairo University for supervising the present thesis.

Also, my deep thanks are due to Prof. Dr. H.S. Sadek, Chairman of Nuclear Materials Authority, and Head of the Black Sand Project for his encouragement, and for providing all the facilities in this work and supervising it.

Deep thanks to Prof. Dr. Sayed M. Al Qattan, Vice Chairman of Nuclear Materials Authority for his assistance, and supervising this thesis. Dr. Mohamed I. Moustafa, Head of the Physical Concentration Department of the Production Division and Deputy Head of the Black Sand Project, NMA, contributed to the project by offering the Wilfely Table and the Low Intensity Magnetic Separator from the equipment of the Black Sand

Project of NMA. He also supervised the installation and adjustment of these two machines.

I present this work to the spirit of Prof. Dr. Hany Abdel Moneim, former Head of the Reactor Materials Department in acknowledgment to his major role in initiating and accomplishing this work.

I also acknowledge the contribution of Prof. Dr. Mamdouh A.G. Hassan.

The present work was highly encouraged and supported by NMA personal, who had any connection with the Recycling project, but they are too many to be mentioned in person, and this is highly appraised. However, the working team in direct association of the Project should be mentioned for their enthusiasm and perseverance in their assignments, and without them, the work would not have been started, let alone completed.

The members of this team are:

- 1- Hamed Mohamed El-Sayed (Chairman of laboratory workers).

- 2- Mohamed Gamal El-Din Gadallah (Assistant laboratory worker).
- 3- Samir Ahmed Khallil (Assistant laboratory worker).
- 4- Wael Moustafa Ibrahiem (Assistant laboratory worker).
- 5- Ashraf Fathy Abd El-All (Assistant laboratory worker).
- 6- El-Sayed Hamed Mohamed El-Sayed (Assistant laboratory worker).
- 7- Mohamed Hamed El-sayed (Assistant laboratory worker).

Contents

	Page
List of figures	ix
List of tables	xiii
CHAPTER I: INTRODUCTION.....	1
1. Solid industrial wastes in Egypt.....	2
2. Solid industrial wastes in South Africa.....	3
3. Scope of the present work	3
4. Goals of the present work.....	4
CHAPTER II: REVIEW OF LITERATURE.....	7
1. Sources of heavy metals in the environment.....	7
2. Effect of and quality criteria for heavy metals and mineral dusts	9
2.1. Antimony	9
2.2. Arsenic	10
2.3. Aluminum.....	10
2.4. Copper	10
2.5. Manganese	11
2.6. Tin	12
2.7. Nickel.....	12
2.8. Kaolinite and quartz.....	12
3. The environmental pollution in each of Egypt and South Africa	12

	Page
3.1. In Egypt.....	12
3.2. In South Africa.....	15
4. Waste disposal	15
4.1. Waste prevention and minimization.....	16
4.2. Resource recovery.....	16
4.3. Waste pre-treatment.....	18
5. Welding	18
5.1. Arc-welding.....	18
5.2. Resistance welding.....	21
5.3. Oxyacetylene welding.....	21
5.4. The application of welding.....	22
6. Welding rods.....	23
6.1. The chemical reasons for using coating electrodes.....	24
6.2. The electrical reasons for using coating electrodes.....	25
6.2.1 Rutile	25
6.2.2 Ferromanganese.....	28
6.2.3 Kaolinite	30
6.2.4 Iron fillings.....	31
6.2.5 Quartz.....	32
6.2.6 Cellulose	33

	Page
CHAPTER III: MATERIALS AND LETHODS	36
1. Materials.....	36
2. Methods	46
2.1 Breaking crushing.....	48
2.2 Dissociation by soaking.....	50
2.3 Separation by decantation.....	52
2.4 Wet sieving	54
2.5 Gravimetric separation.....	58
2.6 Drying	63
2.7 Magnetic separation.....	65
2.8 Dry sieving.....	69
2.9 Stereomicroscope.....	72
2.10 Scanning electron microscope.....	72
2.11 X-ray diffraction	72
3. Newly designed devices.....	73
3.1 Air drying of the final products.....	74
3.2 Automated wet sieve.....	76
CHAPTER IV: RESULTS AND DISCUSSION	79
1. Stereomicroscope.....	80
2. X-rays diffraction.....	85
3. X-rays fluorescence analysis.....	89
4. Scanning electron microscope.....	90

	Page
5. Estimating the grade of the separated samples.....	96
CHAPTER V: SUMMARY.....	100
1. Main aim	100
2. The tasks	102
3. Newly designed devices.....	104
4. Identification and specification of the products.....	104
CHAPTER VI: RECOMMENDATIONS.....	106
References.....	108