



شبكة المعلومات الجامعية



شبكة المعلومات الجامعية
@ ASUNET



شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
على 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 والميكروفيلم

بعض المؤلفين
شبكة المؤلفين
Ain Shams University
Information Network
جامعة عين شمس

شبكة المعلومات الجامعية
@ ASUNET

بالرسالة صفحات لح

بالأحلى



شبكة المعلومات الجامعية

@ ASUNET

**ENVIRONMENTAL ASSESSMENT OF
POLLUTION SOURCES ON NEW SETTLEMENT
AREAS**

PRESENTED BY

LUBNA ABDEL AZIZ IBRAHIM

B.SC. (CHEMISTRY), 2000

M.SC. (INORGANIC CHEMISTRY), 2006

A THESIS SUBMITTED

TO

FACULTY OF SCIENCE

FOR

THE DEGREE OF DOCTOR OF PHILOSOPHY OF SCIENCE

(ANALYTICAL CHEMISTRY)

CHEMISTRY DEPARTMENT

FACULTY OF SCIENCE

CAIRO UNIVERSITY

2011

2223

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



صدق الله العظيم

سورة طه

الآيه 114

APPROVAL SHEET FOR SUBMISSION

Title of the Thesis: Environmental Assessment of Pollution Sources on New Settlement Areas.

Name: Lubna Abdel-Aziz Ibrahim

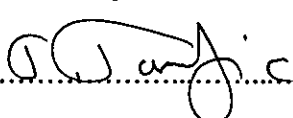
This thesis has been approved for submission by the supervisors:

1. Prof. Dr. Moatza M. Khater.....

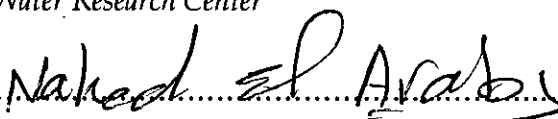
*Professor of Analytical Chemistry and Inorganic Chemistry, Chemistry Department,
Faculty of Science, Cairo University.*

2. Dr. Ahmed F.A. Youssef.....

*Associate Professor of Analytical Chemistry, Chemistry Department, Faculty of
Science, Cairo University.*

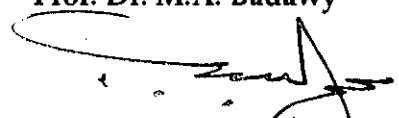
3. Prof. Dr. Tarik A. Tawfic

*Director of Central Laboratory of Environmental Quality Monitoring (CLEQM),
National Water Research Center*

4. Prof. Dr. Nahed E. El-Arabi

Director of Groundwater Research Institute (GRI), National Water Research Center

Prof. Dr. M.A. Badawy


**Chairman of Chemistry Department
Faculty of Science-Cairo University**

ABSTRACT

Name: Lubna Abdel-Aziz Ibrahim

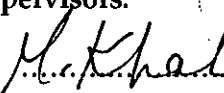
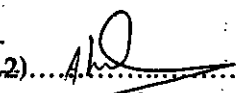
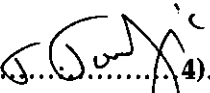
Title of the Thesis: Environmental Assessment of Pollution Sources on New Settlement Areas.

Degree: Ph.D. Thesis, Chemistry, Faculty of Science, Cairo University.

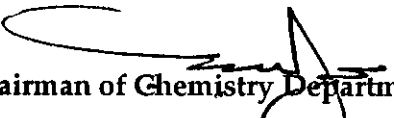
Two areas were studied in this work, Tenth of Ramadan and El-Saff areas, where 38 soil samples, 47 groundwater, 25 water and 16 sediment samples have been analyzed. The present work involves water analysis, characterization of sediment and soil samples, geochemical speciation of trace elements in wastewater, sediment and soil leachates applying the Visual MINTEQ program version 2.53 and fractionation of trace elements by sequential extraction scheme. In addition, the suitability of four sources of water have been evaluated for irrigation and the effect these sources on the soil contamination level was evaluated. The hydrochemistry of the groundwater was studied to evaluate the groundwater for the different uses. Regression analyses showed that, the amount of extractable metals are dependent on their total concentration in soils. For groundwater samples, the results showed that, most of the wells in these areas are unsuitable for drinking, but moderate to excellent in livestock, poultry and agriculture uses.

Key Words: Wastewater, ponds, sediment, soil, geochemical speciation, fractionation, trace elements, groundwater and hydrochemistry.

Supervisors:

1)  2)  3)  4) 

Prof. Dr. M.A. Badawy


Chairman of Chemistry Department
Faculty of Science-Cairo University

ACKNOWLEDGMENT

The author wishes to express her deep thanks, appreciation and sincere gratitude to Prof. Dr. M. M. Khater Professor of Analytical Chemistry and Inorganic Chemistry, Chemistry Department, Faculty of Science, Cairo University; Dr. A. F. Youssef Associate Professor of Analytical Chemistry, Chemistry Department, Faculty of Science, Cairo University; Prof. Dr. Tarik A. Tawfic Director of Central Laboratory of Environmental Quality Monitoring (CLEQM), National Water Research Center, Prof. Dr. Nahed E. El-Arabi Director of Groundwater Research Institute (GRI), National Water Research Center for suggesting the problem, valuable guidance, helpful comments, kind interest and fruitful discussion through this study.

The author is thankful for the support of Prof. Dr. Mohamed Mokhtar Yehia for his support, valuable comments, guidance and patience.

The author is thankful for the support of the Central Laboratory of Environmental Quality Monitoring (CLEQM) and Groundwater Research Institute, (GRI); for giving her all the facilities to do her work.

Finally, I extend my deepest gratitude to my mother and my sisters for their encouragement and love.

TABLE OF CONTENTS

Approval sheet	
Abstract	
Acknowledgment	
Table of contents.....	I
List of figures.....	XI
List of maps.....	XVIII
List of photos.....	XVIII
List of tables.....	XIX
List of symbols.....	XXIII
Aim of work.....	XXX
 CHAPTER I	 1
INTRODUCTION	1
I.1. General Introduction.....	1
1.1.1. Background.....	1
1.1.2. Wastewater.....	2
A. Wastewater origin.....	2
B. Types of wastewater treatment facilities.....	3
▪ Oxidation ponds.....	3
▪ Anaerobic ponds.....	3
▪ Aerobic ponds.....	4
i. Shallow ponds.....	4

ii. Aerated ponds.....	5
▪ Facultative ponds.....	5
▪ Maturation ponds.....	5
I.1.3. Sediment.....	6
I.1.4. Soil.....	6
I.1.5. Sources of trace elements in sediment and soil.....	7
I.1.6. Groundwater contamination.....	7
I.2. Literature survey.....	8
I.2.1. Wastewater and pond water.....	8
I.2.2. Sediment and soil.....	12
I.2.3. Species and fractions.....	18
I.2.3.1. Speciation of trace elements in water, sediment and soil leachates.....	18
I.2.3.2. Fractions of trace elements in sediment and soil solid phase.....	30
I.2.4. Hydrochemistry of groundwater.....	36
CHAPTER II	48
EXPERIMENTAL	48
II.1. Reagents.....	48
II.2. Instruments.....	49
II.2.1. Field instruments.....	49
II.2.2. Laboratory instruments.....	49
II.3. Laboratory study.....	50

II.4. Description of the studied areas.....	51
II.5. Sampling and preservation.....	56
A. Tenth of Ramadan area.....	56
A.1. Wastewater and sediment samples.....	56
A.2. Soil samples.....	58
A.3. Groundwater.....	59
B. El-Saff area.....	59
B.1. Water samples.....	59
B.2. Soil samples.....	61
B.3. Groundwater samples.....	61
II.6. Working procedures.....	63
II.6.1. Surface water and groundwater analyses.....	63
II.6.1.1. pH, EC, Eh and alkalinity.....	63
II.6.1.2. Total dissolved solids (TDS).....	63
II.6.1.3. Biochemical oxygen demand (BOD).....	63
II.6.1.4. Chemical oxygen demand (COD).....	64
II.6.1.5. Dissolved organic carbon (DOC).....	64
II.6.1.6. Trace elements determination.....	64
II.6.1.7. Major cations determination.....	65
II.6.1.8. Anions determination.....	65
II.6.2. Sediment and soil analyses.....	67
A. Tenth of Ramadan area.....	67
A.1. Sediment and soil characteristics.....	67

A.2. Geochemical speciation of trace elements in wastewater, sediment and soil leachates.....	67
A.3. Trace element fractionation and analysis.....	69
B. El-Saff area.....	70
B.1. Soil characteristics.....	70
B.2. Geochemical speciation of trace elements in soil leachates.....	70
B.3. Chemical extractability of trace elements in contaminated soil.....	71
i. Deionized water and 0.01 M CaCl ₂ extraction	71
ii. NH ₄ HCO ₃ -DTPA (AB-DTPA) extraction.....	71
iii. 10% citric acid extraction.....	72
iv. 1 M NaOAc extraction.....	72
v. Soil digestion.....	72
II.7. Quality control checks.....	72
 CHAPTER III	 73
RESULTS AND DISCUSSION	73
III.1 Tenth of Ramadan area.....	73
A. Wastewater characterization.....	73
A.1. pH and Alkalinity.....	73
A.2. Redox Potential (Eh).....	76
A.3. Dissolved oxygen (DO).....	76
A.4. Biochemical oxygen demand (BOD).....	77
A.5. Chemical oxygen demand (COD).....	77

A.6. Dissolved organic carbon (DOC).....	78
A.7. Soluble salts.....	78
A.8. Trace elements.....	81
B. Characteristics of sediment and soil.....	83
B.1. Particle size distribution.....	83
B.2. pH.....	86
B.3. Electrical conductivity.....	87
B.4. Organic carbon.....	89
B.5. Calcium carbonate.....	90
B.7. Trace element concentrations in the sediment and soil samples in comparison with the sediment and soil quality guidelines.....	90
C. Geochemical speciation of trace elements in wastewater, sediment and soil leachates.....	94
C.1. Distribution of element species in wastewater, sediment and soil leachates.....	94
1. Cadmium speciation.....	94
2. Copper speciation.....	97
i. Cuprous species.....	97
ii. Cupric species.....	99
3. Lead speciation.....	101
4. Zinc speciation.....	104
C.2. Relation between metal ions activity and solid phases.....	106
1. Cadmium.....	107
2. Copper.....	110