## THE ENVIRONMENTAL IMPACTS OF USING SEWAGE WATER FOR IRRIGATION AND HOW TO REHABILITATE

(Case Study: Ghammaza Drain in Helwan Governorate)

#### Presented by

#### **Hoda Mohammed Ismail Youssef**

B. Sc. Major. Chemistry Department Faculty of Science - Ain Shams University- (1990)

A Thesis submitted in Partial Fulfillment
Of
The Requirements for Master Degree
In
Environmental Science

Department Of Basic Environmental Science Institute of Environmental Studies and Research Ain Shams University (2015)

#### **Approval Sheet**

# Title: THE ENVIRONMENTAL IMPACTS OF USING SEWAGE WATER FOR IRRIGATION AND HOW TO REHABILITATE

(Case Study: Ghammaza Drain in Helwan Governorate)

This thesis Towards a Master Degree in	
Environmental Science Has been Approved by:	
Name	Signature
Prof. Dr. Mahmod Ahmed Ibrahim Hewehy Prof. Of Public Health at Basic Science Department Institute of Environmental Studies and Research Ain Shams University. Cairo, Egypt.	
Prof. Dr: Mohamed Gharib al-Maliki Prof. Of Geology at Basic Science Department Institute of Environmental Studies and Research Ain Shams University. Cairo, Egypt.	
<b>Prof. Dr: Iman Mohammed Fawzi</b> Professor of Microbiology Faculty of Education, Ain Shams University	
Dr. Eysa Ahmed Abdel-Hamid Shady Senior of Environmental Researchers Environmental Affairs Agency Cabinet of Ministers	

# Title: THE ENVIRONMENTAL IMPACTS OF USING SEWAGE WATER FOR IRRIGATION AND HOW TO REHABILITATE

(Case Study: Ghammaza Drain in Helwan Governorate)

## Presented by **Hoda Mohammed Ismail Youssef**

B.Sc. Chemistry Department, Faculty of Science, Ain shams University (1990)

A thesis submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
In
Environmental Science
Department Of Environmental Basic Science

#### Under The supervision of

Name	Signature
Prof. Mahmod Ahmed Ibrahim Hewehy	
Prof. of Public Health at Basic Science Department	
Institute of Environmental studies & Research,	
Ain Shams University	
Dr. Eysa Ahmed Abdel-Hamid Shady	
Senior of Environmental Researchers	
Environmental Affairs Agency	
Cabinet of Ministers	

#### **ACKNOWLEDGEMENT**

My great gratitude and sincere thanks should be submitted to ALLAH for the kind and continuous support to me.

I wish to express my deep thanks and appreciation to

Prof. Dr. Mahmod Ahmed Ibrahim Hewehy

Prof. of Public Health at Basic Science Department,
Institute of Environmental Studies and Research
Ain Shams University, Cairo, Egypt

For

Suggesting this work, his effort and guidance to solve all problems that was faced, Words cannot express my deep feeling of appreciation toward his kind effort and remarks until the end of the work and also for his help in presenting this thesis and discussion of the results.

Many thanks to Dr. Eysa Ahmed Abdel-Hamid Shady

Egyptian Environmental Affairs Agency,
Senior of Environmental Researchers
Cabinet of Ministers, Cairo, Egypt
For his continuous encouragement.

Hoda Mchammed Ismail Youssef

#### **MEMORANDUM**

I certify here that this thesis contains a report of work carried out in Public Health at Basic Science Department, Institute of Environmental Studies and Research, Ain Shams University, Cairo, Egypt.

This work is original except where accredited and has not submitted for any other degree at this or at any other university.

Signature

Hoda Mohammed Ismail Youssef

### Dedication

To:

My Father Mother Husband & Sons

Hoda Mohammed Ismail Youssef

### **CONTENTS**

Subject.	Page No.
ACKNOWLEDGEMENT	
MEMORANDUM	
Dedication	
ABBREVIATIONS	
CONTENTS	
List of Figures	
List of Tables	
CHAPTER (1)	
Introduction	1
Objective of the Study	4
CHAPTER (2)	
Literature Review	7
Effective Microorganisms (EM) for environmental	12
applications	
1. Bioremediation bacteria for corrosion control.	12
Septic tank cleaning and wastewater odor control.	12
Septic Tank	13
Case study	15
2. New Approach to Wastewater Treatment:	17
3. The Successful Trial of the (EM) Method in the	19
Septic Tank of a Private Home	
4. Application of The (EM) Method	25
5. Massive savings in Electricity and Water Charges	30

Subject.	Page No.
6.Good-Quality Recycled Water	34
7.EM Potential to Clean Up Badly Polluted Stretches of Water	37
8. Operations Begin With the Major Source of Water Pollution	41
9. The Septic Tank System of Private Homes	42
10. In Garden Fish Ponds	43
11. General Cleaning, Deodorizing, and Cleaning Up in the Home	44
12. The Process of Treating Kitchen Garbage	44
13. Private Sector	46
14. Swimming pools	50
CHAPTER (3)	
Materials and Methods	55
a) Work plan	55
Testing of Effective Microorganisms (EM):	60
Application of (EM):	61
Activating the Effective Microorganisms (EM)	61
b) Water Analysis	62
Methods of Water Analysis	62
1- Biological Oxygen Demand (BOD)	62
2- CHEMICAL OXYGEN DEMAND (COD)	65
3- TDS Meters and Testers	67
<ul> <li>4- Method for Nitrate Reductase Nitrate-Nitrogen</li> <li>Analysis</li> </ul>	69

Subject.	Page No.
5- Hexane Extractable Material (HEM; Oil and Grease)	73
6- Reagents and Standards	75
CHAPTER(4)	
Results	78
CHAPTER (5)	
Discussion Summary and Conclusion	
Discussion	99
Summary & Conclusion	102
Recommendations	107
REFERENCES	108

## **List of Figures**

Figure No.	Subject.	Page No.
Figure (1)	Farm Irrigated by Sewage Water	55
Figure (2)	Point Taken Next to The Brick's Factories	56
Figure (3)	Taken 500 meters away from Flood Inflow	57
Figure (4)	Taken Close to Settlements	57
Figure (5)	Sewage Pipes on the Ghammaza Drain	59
Figure (6)	The Researcher while Taking Samples	59
Figure (7)	DO Meter	64
Figure (8)	Biological Oxygen Demand BOD Incubator	64
Figure (9)	Reflux Apparatus	65
Figure (10)	TDS Meters and Testers	67
Figure (11)	Comparison between Results of (BOD) for	83
Tiguic (11)	First Sample with Different Concentrations	
Figure (12)	Comparison between Results of (BOD) for	84
	Second Sample with Different Concentrations	04
Figure (13)	Comparison between Results of (BOD) for	85
1 1guic (13)	third sample with Different Concentrations	
Figure (14)	Comparison between Results of (COD) for	86
	First Sample with Different Concentrations	
Figure (15)	Comparison between Results of (COD) for	87
1 18010 (13)	Second Sample with Different Concentrations	07
	Comparison between Results of (COD) for	
Figure (16)	third sample with Different Concentrations	88

Figure No.	Subject.	Page No.
Figure (17)	Comparison between Results of (TDS) for First Sample with Different Concentrations	89
Figure (18)	Comparison between Results of (TDS) for Second Sample with Different Concentrations	90
Figure (19)	Comparison between Results of (TDS) for Third Sample with Different Concentrations	91
Figure (20)	Comparison between Results of Nitrates for First Sample with Different Concentrations	92
Figure (21)	Comparison between Results of Nitrates for Second Sample with Different Concentrations	93
Figure (22)	Comparison between Results of Nitrates for Third Sample with Different Concentrations	94
Figure (23)	Comparison between Results of Oil and Graces for First Sample with Different Concentrations	95
Figure (24)	Comparison between Results of Oil and Graces for Second Sample with Different Concentrations	96
Figure (25)	Comparison between Results of Oil and Graces for Third Sample with Different Concentrations	97

### **List of Tables**

Table No.	Subject.	Page No.
Table (1)	Results of First Sample with EM Concentration 1:5000	78
Table (2)	Results of First Sample with EM Concentration 1:10000	78
Table (3)	Results of First Sample with EM Concentration 1:20000	79
Table (4)	Results of Second Sample with EM Concentration 1:5000	79
Table (5)	Results of Second Sample with EM Concentration 1:10000	80
Table (6)	Results of Second Sample with EM Concentration 1:20000	80
Table (7)	Results of Third Sample with EM Concentration 1:5000	81
Table (8)	Results of Third Sample with EM Concentration 1:10000	81
Table (9)	Results of Third Sample with EM Concentration 1:20000	82
Table (10)	Results of BOD First Sample with Different Concentration	83
Table (11)	Results of BOD Second Sample with Different Concentration	84
Table (12)	Results of BOD Third Sample with Different Concentration	85
Table (13)	Results of COD First Sample with Different Concentration	86
Table (14)	Results of COD Second Sample with Different Concentration	87

Table No	Cartina	
Table No.	Subject.	No.
Table (15)	Results of COD Third Sample with Different	88
	Concentration	00
Table (16)	Results of TDS First Sample with Different	89
Table (16)	Concentration	09
Table (17)	Results of TDS Second Sample with Different	90
Table (17)	Concentration	90
Table (10)	Results of TDS Third Sample with Different	91
Table (18)	Concentration	91
Table (10)	Results of Nitrates First Sample with Different	92
Table (19)	Concentrations	92
Table (20)	Results of Nitrates Second Sample with Different	93
Table (20)	Concentrations	93
Table (21)	Results of Nitrates Third Sample with Different	94
	Concentrations	94
Table (22)	Results of Oil and Graces First Sample with	95
	Different Concentrations	93
Table (23)	Results of Oil and Graces Second Sample with	96
	Different Concentrations	90
Table (24)	Results of Oil and Graces Third Sample with	97
	Different Concentrations	71

## CHAPTER (1)

#### **Introduction:**

A major problem facing municipalities throughout the world is the treatment, disposal and/or recycling of sewage sludge. Generally sludge from municipal waste consists mainly of biodegradable organic materials with a significant amount of inorganic matter (Elliot 1986).

However, sludge exhibits wide variations in the physical, chemical and biological properties (Colin et al. 1988; Bruce 1990). At the present time, there are a number of methods being used to dispose of sewage sludge from disposal to landfill to land application.

Although there are many methods used, there are numerous concerns raised regarding the presence of constituents including heavy metals, pathogens and other toxic substances. This requires the selection of the correct disposal method focusing on efficient and environmentally safe disposal. New technologies are being produced to assist in the treatment and disposal of sewage sludge, conforming to strict environmental regulations. One of these new technologies being proposed is the use of Effective Microorganisms (EM).

The technology of Effective Microorganisms (EM) was developed during the 1970's at the University of Ryukyus, Okinawa, Japan (Sangakkara 2002). Studies have suggested that (EM) may have a number of applications, including agriculture, livestock, gardening and landscaping, composting, bioremediation, cleaning septic tanks, algal control and household uses (EM Technology 1998).

(EM) has been employed in many agricultural applications, but is also used in the production of several health products in South Africa and the USA (United States of America).