Ain Shams University
Faculty of Women for Arts,
Science and Education

Study on the Role of Some Microorganisms in the Biotransfer of Radionuclides in Different Rock Samples from Sinai, Egypt.

A Thesis
Submitted in Partial Fulfillment of the Requirements for
The Degree of
Doctor of Philosophy in Science
in
Microbiology
by

Noha Mohamed Kamal Abdelfattah
M.Sc. in Microbiology (2013)

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2019

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Approval Sheet

Title: Study on the Role of Some Microorganisms in the Biotransfer of Radionuclides in Different Rock Samples from Sinai, Egypt.

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Dedication

I would like to dedicate this work to my wonderful mother Soaad, my great father Mohamed, my dear husband Moustafa, my lovely daughters Fatma and Asya, my brothers, my sisters, my nieces and my friends and also to express my sincere and deepest thanks to them for putting up with me and for their great help and support all the time.

Noha M. Kamal

Acknowledgements

First, I can't be thankful enough for Allah to whom I am indebted for his blessings on me.

I would especially like to thank my supervisors for initially accepting me as a PhD Candidate, for their commitment to science which has been an inspiration to me and for conveying the meaning of a successful team work to me.

I owe my deepest gratitude and debt to Prof. Maha A. Hewedy who was always there for me since I was an undergraduate student. She taught me scientific as well as ethical principles and put me on the right track by introducing me to the amazing world of Geomicrobiology and Environmental Biotechnology which became my passion. She also provided me with all the possible means and tools that could help me during my studies. And above all, she stood by my side in every situation and helped me get up on my feet whenever I was feeling down.

I would like to express the deepest appreciation to Prof. Ibrahim E. Elaasy for his constructive criticism, helpful and enlightening discussions. He was always there whenever I needed his opinion and stood by me during my lab work in spite of being extremely busy. He taught me that there is no "pure" science and that a research study is better by collaborating with researchers in many fields.

My deepest heartfelt appreciation goes to Dr. Shimaa M. Abdelsalam for her endless encouragement, valuable ideas, uncountable basic editing, independent thinking and her ability to find creative simple solutions to complex problems. She was always there for me whenever I needed her and praised whatever I did, in both written and spoken forms, before giving me corrections or any criticism.

I am deeply grateful to Dr. Nareman M. Harpy for her guidance during my studies, providing me with any materials needed whenever asked to and standing with me in lab teaching me many techniques. I would also like to thank her for the continued support over the past 2 years.

I would like to thank Nuclear Materials Authority of Egypt, Atomic Energy Authority and Egyptian Nuclear and Radiological Regulatory Authority, for their assistance in SEM, TEM and Gamma ray studies.

I would also like to express my deepest appreciation and admiration for the Egyptian Knowledge Bank team, the owner of the idea of building it up and anyone who participated in this giant project that is providing me with knowledge treasures from different valuable sources easily and for free.

Special thanks goes to Faculty of Women for Arts, Science and Education, Ain Shams University, for providing lab facilities and chemicals needed during the study.

Finally, I would like to extend my sincere appreciation and acknowledge to past and present doctors, colleagues and lab-mates in Botany and Physics Department, Faculty of Women for Arts, Science and Education, Ain Shams University who taught me and helped me since I've entered my university as an undergraduate student till now.

To you all, I say *Thanks*!

Noha M. Kamal

Table of Contents

List of Abbreviations

$(U,Ca,Ce)(Ti,Fe)O_6$	Brannerite
µm	Micrometer
API	Acid production index
ATCC	American Type Culture Collection
ATSDR	Agency for Toxic Substances and Disease Registry
BIM	Biologically induced mineralization
$Ca(UO_2)_2(PO_4)_2$	Autunite
calcite	Calcium carbonate
CFU	Colony forming units
DNA	Deoxyribonucleic acid
ENRRA	Egyptian Nuclear and Radiological Regulatory Authority
EPA	Environmental Protection Agency
EPS	Extracellular polymeric substances
F	Forward
FAA	Flame Atomic Absorption
H_2O_2	Hydrogen peroxide
H_3PO_4	Orthophosphoric acid
HPGe	High Purity Germanium

IAEA	International Atomic Energy Agency
ICP-MS	Inductively coupled plasma mass spectrometry
ICP-OES	Inductively Coupled Plasma Optical Emission Spectrometry
ISP	International *Streptomyces* Project
ISP6	Peptone yeast extract iron medium
ISP7	Tyrosine agar medium
ISP9	Carbon utilization agar medium
ITS	Internal transcribed spacer
KeV	Kilo electronvolt
LB	Luria-Bertani
LOI	loss-on-ignition
LSD	Least Significant Difference
Me	Metal
mg	Milligram
MICP	Microbially-induced calcium carbonate precipitation
mm	Millimeter
MSM	Molasses-salt medium
NCBI	National Center for Biotechnology Information

NFS	Nuclear field shift
$NH_4[Fe(H_2O)_6](SO_4)_2.6H_2O$	Ammonium ferrous sulphate
NH_4VO_3	Ammonium metavanadate
NMA	Nuclear Material Authority
NNRL	Northern Regional Research Laboratory
OC	Organic carbon
OM	Organic matter
PCSs	Phytochelatin synthases
PDA	Potato dextrose agar
PLFA	Phospholipid fatty acid
ppm	Part per million
PSI	Phosphate solubilization index
R	Reverse
r	Pearson coefficient
RfD	Reference Dose
rpm	Round per minute
rRNA	Ribosomal ribonucleic acid
S–L	Solid-liquid
SRB	Sulfate-reducing bacteria