



شبكة المعلومات الجامعية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ





شبكة المعلومات الجامعية



شبكة المعلومات الجامعية

التوثيق الالكتروني والميكرو فيلم

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 بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %



شبكة المعلومات الجامعية



بعض الوثائق الأصلية تالفة



شبكة المعلومات الجامعية



بالرسالة صفحات

لم ترد بالأصل



B 199v

**The Behavioural Response of
Rhodobacter capsulatus B10 and 37b4
to Cadmium and Zinc toxicity**

**A Thesis
Submitted, In Partial Fulfillment,
For the Degree of M.Sc. In Microbiology (Bacteriology)**

**By
Sanna Mohamed Fahmy
B.Sc. In Botany , Assiut University**

**Supervised by
Prof. Dr. A.A.Shoreit
Prof. of Microbiology
Botany Department
Faculty of Science
Assiut University**

**Dr. A.E. El-Enany
Assistant Prof. of
Plant Physiology
Botany Department
Faculty of Science
Assiut University**

**Dr. H.M.A. Ragheb
Assistant Prof. of
Soil Sci., and Water
Soil Sci., and Water Depart
Faculty of Agriculture
Assiut University**

**Botany Department
Faculty of Science
Assiut University**

2001

Approval Sheet

Name: Sanna Mohamed Fahmy

Thesis Title : The behavioural response of *Rhodobacter capsulatus* B10 and 37b4 to cadmium and zinc toxicity.

Degree: The degree of M.Sc. Botany (Microbiology - Bacteriology).

Supervisors

- 1- Prof. A.A.M. Shoreit (Prof. of Microbiology- Faculty of Science – Assiut University).
- 2- Dr. A.E. El-Enany (Assistant Prof. of Plant Physiology- Faculty of Science – Assiut University).
- 3- Dr. H.M.A. Ragheb (Assistant Prof. of Soil Sci. and Water- Faculty of Agriculture – Assiut University).

Examination Committee

External :

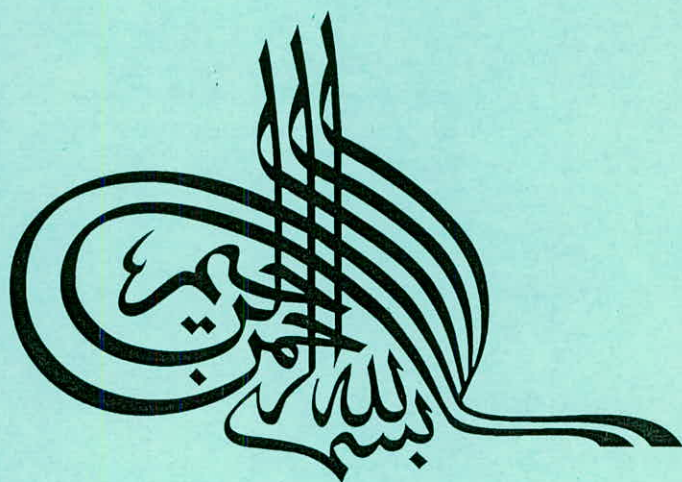
- 1- Prof. Y. A. Elzawahry (Prof. of Microbiology- Faculty of Science – Zagazig University).
- 2- Prof. H. H. Zahran (Prof. of Microbiology- Faculty of Science – Beni-suef - Egypt).

Internal :

- 1- Prof. A.A.M. Shoreit (Prof. of Microbiology- Faculty of Science – Assiut University).
- 2- Dr. A.E. El-Enany (Assistant Prof. of Plant Physiology- Faculty of Science – Assiut University).

Prof. M. T. Ismail

Vice-Dean for Graduate Studies and Research



ACKNOWLEDGEMENT

No words can ever express my sincere gratitude to Allah Who guides, aids, and blesses me in every thing and everywhere in my life

I would like to take the opportunity to express my sincerest appreciation and gratitude to **Prof. Dr. A.A.M. Shoreit**. *not* only for his valuable suggestions and keen supervision of this work, but also for his human kindness, fruitful advice, tireless efforts and encouragement at all stages of this work.

My sincere thanks and gratitude go to **Dr. A.E. El-Enany and Dr Hussin Ragheb** for their suggestions, supervision and encouragement of this work.

Sincere thanks and deepest appreciation go to **Prof. Dr. M.E. Abdel-Kader**, Dean of the Faculty of Science, Assiut University for the facilities provided and his encouragement.

Sincere thanks also go to **Prof. Dr. F.M. Salama**, Head of Botany Department, Faculty of Science, Assiut University for the facilities offered and kind help.

Thanks are due to *all members* of Botany Department, Faculty of Science, Assiut University, who encouraged me to complete this work.

Sanna Mohamed Fahmy.

CONTENTS	Page
1. Introduction.	
1.1 Classification of heavy metals.	1
1.2 Sources of pollution by heavy metals.	2
1.3 Effect of Cd and Zn on microorganisms.	2
1.4 Effect of heavy metals on morphology, growth and photopigment.	4
1.5 Biosorption and bioaccumulation.	5
1.6 Capsule and heavy metal tolerance.	5
1.7 Interaction of cell surface with heavy metals.	7
1.8 Cell wall of gram negative bacteria.	10
1.9 Outer membrane of gram negative bacteria	10
1.10 Mechanisms of microbial metal accumulation.	11
1.11 Classification of anoxygenic photosynthetic bacteria.	13
1.12 Rhodospirillaceae , rare-earth oxyanions and heavy metals.	16
Objective	18
2.0 Materials and methods:	
2.1 Organisms and growth conditions .	19
2.2 Composition of RÄH medium.	19
2.3 Determination of growth criteria.	20
2.3.1 Optical density .	20
2.3.2 Protein determination.	20
2.3.3 Fresh weight and dry weight.	21
2.4 Bacteriochlorophyll-a.	22
2.4.1 Absorption spectrum of photopigment .	22
2.4.2 Determination of bacteriochlorophyll-a.	23
2.5 Scanning Electron Microscope (SEM).	23
2.6 Cellular Partition.	24
2.6.1 Preparation of cell free extract.	24
2.6.2 Precipitation of proteins.	26
2.6.3 Gel filtration technique.	26
2.7 Protein and lipopolysaccharide (LPS) analysis by SDS-polyacrylamide gel electrophoresis (SDS-PAGE).	
2.7.1 SDS- PAGE solutions.	29
2.7.2 Preparation of 12% and 5% SDS-PAGE.	30
2.7.3 Electrode buffer solution.	31
2.7.4 Loading buffer (2X) (double concentration).	31
2.7.5 Protein and LPS analysis.	31

2.7.6	Sample loading and application.	32
2.7.7	Electrophoresis.	32
2.7.8	Protein staining solution.	33
2.7.9	Staining of LPS by silver staining.	33
2.7.10	Protein and LPS scanning.	35
2.7.11	Molecular weight determination of protein.	35
3.	Experimental Results	
3.1	The effect of cadmium and zinc on growth criteria.	36
3.1.1	The effect on growth curve.	36
3.1.2	The effect on protein content.	40
3.1.3	The effect on photopigments and bacteriochlorophyll-a content .	42
3.1.4	The effect on morphology.	46
3.2	Accumulation and partition of cadmium.	46
3.3	Accumulation and partition of zinc.	48
3.4	Gel filtration.	
3.4.1	Cd-binding protein at 10, 20 ppm Cd^{2+} .	53
3.4.2	Zn-binding protein at 20, 40 ppm Zn^{2+} .	58
3.5	Alteration of protein profiles in SDS-PAGE of <i>Rb.capsulatus</i> B10 and 37b4 under cadmium stress.	63
3.6	Alteration of protein profiles in SDS-PAGE of <i>Rb.capsulatus</i> B10 and 37b4 under zinc stress.	65
3.7	Alteration of lipopolysaccharides profiles in SDS-PAGE of <i>Rb.capsulatus</i> B10 and 37b4 under cadmium stress.	68
3.8	Alteration of lipopolysaccharides profiles in SDS-PAGE of <i>Rb.capsulatus</i> B10 and 37b4 under zinc stress.	68
4.0	DISCUSSION.	72
5.0	ENGLISH SUMMARY.	83
6.0	REFERENCES.	87
7.0	ARABIC SUMMARY.	