



Faculty of Science  
Microbiology Department

***Production of polysaccharides and  
oligosaccharides from immobilized  
dextransucrase produced from  
honey bacterial isolates***

Thesis Submitted for the Degree of Doctor Philosophy of  
Science  
(Microbiology)

By

***Amira Gamal Abd El-Rahim***

Microbiology Department  
Faculty of Science  
Ain Shams University  
(2016)





\*فَالْمُؤَسِّبُ مَا عَلِمَ لَنَا إِلَّا مَا عَلِمْنَا

إِنَّمَا أَنْفُسُ الْعَالَمِينَ الْحَكِيمِينَ \*

صَدَقَ اللَّهُ الْعَظِيمُ





Faculty of Science  
Microbiology Department

***Production of polysaccharides and oligosaccharides  
from immobilized dextranucrase produced from  
honey bacterial isolates***

A Thesis Submitted to  
Faculty of Science  
Ain Shams University  
For the Fulfillment of the Degree of Doctor Philosophy (PhD) of  
Science  
In  
(Microbiology)

**By**

***Amira Gamal Abd El-Rahim Hefny***  
(B.Sc. Microbiology/ Chemistry 2008)  
(M.Sc. Microbiology 2013)

Supervised by

**Prof. Dr.**  
**Naziha Mohamed Hassanein**  
Prof. of Microbiology  
Microbiology Department  
Faculty of Science  
Ain Shams University

**Prof. Dr.**  
**Amal M. Abd El- Gawad Hashem**  
Prof. of Microbiology  
Natural and Microbial Products Chemistry  
Department  
National Research Centre

**Prof. Dr.**  
**Mona Abd El- Tawab Esawy**  
Prof. of Microbiology  
Natural and Microbial Products Chemistry  
Department  
National Research Centre  
(2016)





Faculty of science  
Microbiology Department

## **Approval Sheet**

**Name:** Amira Gamal Abd El-Rahim Hefny.

**Title:** Production of polysaccharides and oligosaccharides from immobilized dextranucrase produced from honey bacterial isolates.

**Degree:** Ph.D in Microbiology.

**This Thesis for PhD Degree has been approved by the following:**

### **Advisory Committee**

**1. Prof. Dr. Zeinat Kamel Mohamed**

Prof. of Microbiology, Botany and Microbiology Department, Faculty of Science, Cairo university.

**2. Prof. Dr. Ahmed Abd El-Wahab Abd El-Hafez**

Prof. of Microbiology, Agricultural Microbiology Department, Faculty of Agriculture, Ain Shams university.

**3. Prof. Dr. Naziha Mohamed Hassanein**

Prof. of Microbiology, Microbiology Department, Faculty of Science, Ain Shams university.

**4. Prof. Dr. Amal M. Abd El- Gawad Hashem**

Prof. of Microbiology, Natural and Microbial Products Chemistry Department, National Research Centre.

**Date of examination:**

**24 /8 / 2016**





*This thesis has not been previously  
submitted for any degree at this or at  
any other university.*

*Signed  
Amira Gamal Abd El-Rahim*



## **Acknowledgement**

*Firstly and forever, thanks to Allah for helping me to complete this thesis and showing me the right path.*

*I wish to express my deep gratitude to Professor Dr. **Naziha Mohamed Hassanein**, Professor of Microbiology, Microbiology Department, Faculty of Science, Ain Shams University for her kind supervision, support, constructive criticism, remarkable observations and careful revision of the thesis.*

*I am heartily and warmly thankful to my supervisors, professor Dr. **Amal Mohamed Hashem** and professor Dr. **Mona Abd El- Tawab Esawy**, Professors of Microbiology, Chemistry of Natural and Microbial Products Department, National Research centre (NRC), Dokki, Cairo, for their continuous encouragement, useful help, valuable suggestions, kind supervision in this work, fruitful discussion, and for critical reading and writing the thesis.*

*I deeply thank professor Dr. **Ghada E.A. Awad**, Professor of Microbiology, Chemistry of Natural and Microbial Products Department, National Research center (NRC), Dokki, Cairo, for her continuous and useful help during the experimental work dealing with the mathematical and stastical modeling.*

*I deeply thank professor Dr. **Nahla M. Mansour**, Professor of Microbiology, Chemistry of Natural and Microbial Products Department, National Research center (NRC), Dokki, Cairo, for her continuous and useful help during the molecular identification for the most potent bacteria.*

*I deeply thank Dr. **Mohamrd M.I. Helel**, Assistant professor of Microbiology, Chemistry of Natural and Microbial Products Department, National Research center (NRC), Dokki, Cairo, for his continuous and useful*

help during the experimental work dealing with the studying of biological activities of the products (applied experiments).

I deeply thank Dr. **Mohamed E. Hassan**, Researcher of Chemistry, Chemistry of Natural and Microbial Products Department, National Research center (NRC), Dokki, Cairo, for his continuous and useful help during the experimental work dealing with the immobilization process and preparing the immobilization carrier.

Thanks are also extended to the members of the **Department of Natural and Microbial Products Chemistry** and authorities of NRC for kind help and facilities provided and I offer my regards and blessings to all of those who supported me in any respect during the completion of the work,

**And last but not least**, Special thanks to my **family** for their great support, help, love, encouragement throughout my entire life without which I could never go through my work, I love you all.



*Dedication*

*To*

*My mom, Amany & my  
brother, Ahmed & my sister,  
Menna & The spirit of my  
dad, Gamal & my fiancé,  
Gamal & my teachers and  
friends,  
I love you all so much.*



---

# **Contents**

## **Contents**

<b>List of abbreviations .....</b>	<b>I</b>
<b>List of tables .....</b>	<b>II</b>
<b>List of figures .....</b>	<b>III</b>
<b>List of photographs .....</b>	<b>IV</b>
<b>Abstract .....</b>	<b>1</b>
<b>Aim of the work .....</b>	<b>2</b>
<b>1. Introduction .....</b>	<b>4</b>
<b>2. Review of literature .....</b>	<b>7</b>
2.1. Dextranase enzyme .....	8
2.2. Dextran (occurrence and structure) .....	9
2.3. Mechanism of dextran production .....	10
2.4. Microbial sources of dextranase.....	10
2.5. Production of dextranase (production conditions).....	11
2.6. Partial purification strategies of dextranase.....	14
2.6.1. Fractional methods .....	14
2.6.1.1. Fractional precipitation by organic solvents .....	15
2.6.1.2. Fractional precipitation by salts .....	15
2.7. Dextranase immobilization and properties of immobilized enzyme .....	17
2.8. Applications of dextranase.....	21
2.8.1. Enzymatic synthesis of dextrans with different molecular weights .....	21