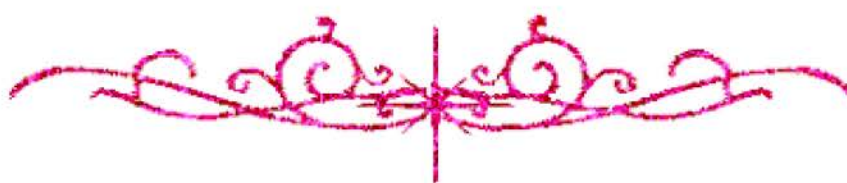


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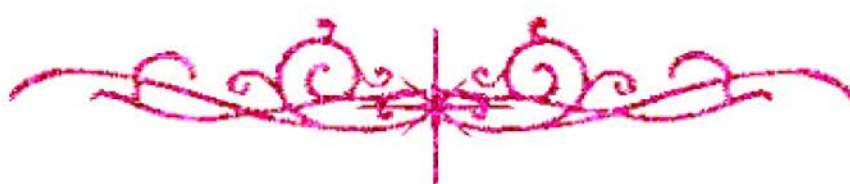
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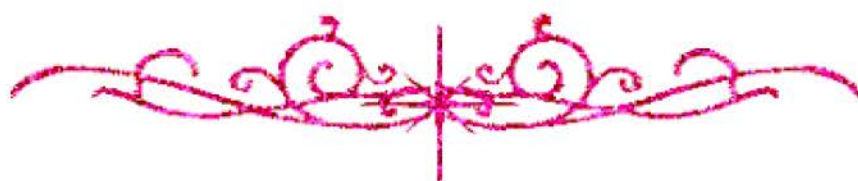
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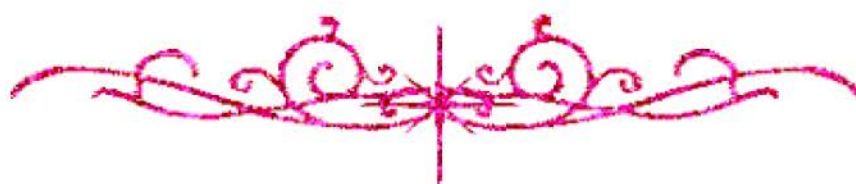
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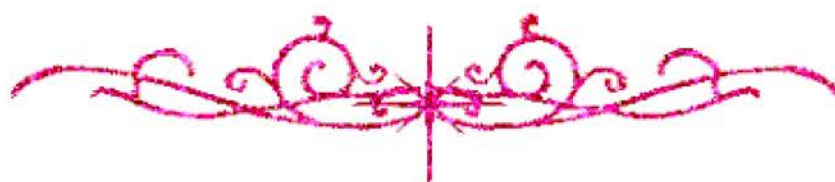
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بالرسالة صفحات لم ترد بالأصل



A THESIS ENTITLED
CHEMICAL MODIFICATION OF CHITOSAN BY GRAFTING
TECHNIQUE.

SUBMITTED BY
DOAA HASSAN ABD ELAAL

(B.Sc., Chemistry 1999)

For
The partial fulfillment of
The Degree of Master of Science

Department of Chemistry
Faculty of Science
University of Cairo

2005

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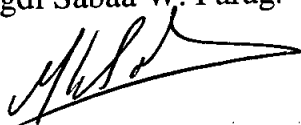
"Chemical modification of Chitosan by grafting technique."

Name of Candidate: *Doaa Hassan Abd Elaal Hassan.*

This thesis has been approved for submission by the supervisors:

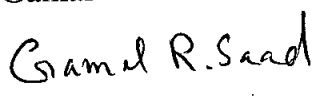
1) Prof. Dr. Magdi Sabaa W. Farag.

Signature:



2) Prof. Dr. Gamal Riad Saad.

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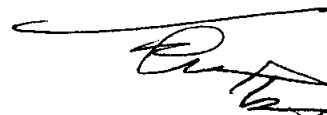
3) Dr. Emad Hamdy Orabi.

Signature:



Prof. Dr. Rifaat H. Hilal.

Chairman of Chemistry Department.
Faculty of Science,
Cairo University.



Abstract.

- **Name:** Doaa Hassan Abd El Aal.
- **Title of the thesis:** Chemical Modification of Chitosan by Grafting Technique.
- **Degree:** M.Sc. unpublished Master of Science Thesis, Faculty of Science- Cairo University-2005.

Graft Copolymerization of Glycidyl methacrylate (GMA), Methacrylic acid (MAA), Itaconic acid (IA) and 2-vinyl pyrrolidone (VP) onto Chitosan was carried out using potassium persulphate as an initiator.

The effect of the reaction variables such as; monomer concentration, Initiator Concentration, Time and Temperature on the extent of grafting was studied systematically.

Values for the grafting percentages up to 770 %, 286 %, 68% and 67 % for Chitosan-g-PGMA, Chitosan-g-PMAA, Chitosan-g-PIA and Chitosan-g-PVP, respectively, were reached. The graft copolymers are characterized by FT-IR Spectroscopy, Scanning electron microscope (SEM), Thermogravimetric analysis and solubility test.

It was observed that the solubility of Chitosan in organic acids was reduced after grafting. Moreover, a reproducible high swelling capacity of Chitosan-g-PMAA, Chitosan-g-PIA and Chitosan-g-PVP in distilled water as well as in buffer solutions at pH 4 and pH 10 was observed.

The swelling at equilibrium is highly dependent on the copolymer composition and pH. Chitosan-g-PGMA didn't swell due to the hydrophobic nature of PGMA chains. The adsorption of Cu^{2+} and Ni^{2+} ions in buffer solution onto Chitosan-graft copolymers was examined. The results showed that the adsorption of Cu^{2+} is greater than Ni^{2+} ions.

The results of the adsorption of the dye indicate that the adsorption of the dye is higher in Chitosan-graft-copolymers in comparison with Chitosan and the adsorption is higher with basic dye than with acidic one.

- **Key words:**

Chitosan, Graft Copolymers, Glycidyl methacrylate, Methacrylic acid, Itaconic Acid, 2-Vinyl Pyrrolidone, Thermal analysis, Swellability, Metal uptake.

Cairo University
Faculty of Science.
Department of Chemistry

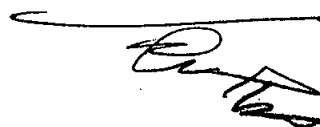
To whom it may concern

Besides the work carried in this thesis, the candidate **DOAA HASSAN ABD ELAAL** had studied the following post-graduate courses during the academic year 2000-2001 and passed their exams successfully.

1. Heterocyclic Chemistry.
2. Organic Spectroscopy.
3. Advanced Physical Organic Chemistry.
4. Natural Products.
5. Biochemistry.
6. Polymer Chemistry.
7. Designing Organic Chemistry.
8. Organic Photochemistry.
10. Methods of Elucidation of Molecular Structure.
11. Advanced Analytical Chemistry.
12. Dyes.
13. Quantum Chemistry.
14. Elective Course (Explosive).
15. Mathematics and Scientific Computations.
16. Functional Group Analysis.
17. Carbohydrates Chemistry.
18. Foreign Language (German).

Prof. Dr.Rifaat H. Hilal

Chairman of the Chemistry Department.



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Summary in Arabic

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DOAA HASSAN ABD ELAAL.

Aim of the Work

Aim of the work.

There has been a growing interest in research devoted to the modification of natural polysaccharide by incorporating specific polymers to bring about changes in their physical and chemical properties.

Chitosan is the modified N-deacetylated chitin. Much attention has been paid to chitosan because it contains both amine and hydroxyl groups, which can easily be modified chemically to produce a wide range of derivatives.

The target of the present work is:

1-The chemical modification of chitosan through grafting it with various vinyl functionalized available monomers such as **glycidyl methacrylate, itaconic acid, methacrylic acid** and **vinyl pyrrolidone** onto chitosan

2-The Investigation for the effect of reaction conditions such as **monomer concentration, initiator concentration, temperature** and **time of grafting** on the graft parameters such as **grafting yield, amount of homopolymer formed**, and **grafting efficiency**.

3- The Characterization of chitosan grafted copolymers by **thermal** and **spectroscopic** analyses and by **scanning electron microscopy**.

4- The effect of modification of chitosan by graft copolymerization on its **dye uptake, metal chelation, swellability, solubility**....., etc.

Chapter (1):
Literature Survey