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**Faculty of Science
Department of Chemistry**

Chemically induced graft copolymerization of some vinyl monomers onto carboxymethyl chitosan

A Thesis

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Requirements for The Master Degree of
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By

**SOLIMAN MEHAWED ABD EL LATIF SOLIMAN
(B. Sc., Cairo University, 2006)**

Department of Chemistry
Faculty of Science
Cairo University
Giza, Egypt
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ABSTRACT

Name: Soliman Mehawed Abd El Latif Soliman.

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Carboxymethyl chitosan (CMCh) has been prepared. The degree of its substitution and elucidation of its structure were determined using elemental analyses and FTIR spectroscopy. Chemical modification of CMCh has been done through grafting using three vinyl monomers namely: acrylonitrile (AN), *N*-vinylimidazole (NVI) and 4-vinylpyridine (4VP). The kinetic parameters of grafting process included monomer concentration, initiator concentration and reaction temperature and time were studied. The grafting parameters such as the percent graft yield (% G), percent graft efficiency (% GE) and percent homopolymer (% H) were calculated. The optimum conditions for the grafting process for each system were determined. Moreover, the grafted copolymers were characterized for their properties using quantitative FTIR spectroscopy, solubility, X-ray diffraction, thermogravimetric analyses and scanning electron microscopy. Applications of the chemically modified CMCh have been concerned such as dye uptake, swellability, and metal sorption. The grafting modification increases the thermal stability, dye uptake of CMCh and the capacity of metal ions uptake increases after amidoximation of CMCh-g-PAN copolymers. The grafted CMCh copolymers using *N*-vinylimidazole have shown a good antimicrobial activity.

Keywords: Carboxymethyl chitosan; Grafting; Acrylonitrile; Amidoxime; *N*-Vinylimidazole; 4-Vinylpyridine; Dye uptake; Swellability; Antimicrobial activity, Metal uptake; Thermal stability.

Supervisors:

1- Prof. Dr. Magdy Sabaa Wadid Farag.

2- Prof. Dr. Nadia Ahmed Mohamed Ahmed.

3- Dr. Riham Rashad Mohamed Ali.

Prof. Dr. Mohamed M. Shoukry

**Chairman of the Department of Chemistry
Faculty of Science, Cairo University**

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الاسم: سليمان مهاود عبد اللطيف سليمان

عنوان الرسالة : البلمرة المشتركة بالتطعيم المستحثة كيميائيا لبعض مونوميرات الفينيل علي الكربوكسي ميثيل كيتوزان

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ملخص البحث:

تم تحضير الكربوكسي ميثيل كيتوزان وتعيين نسبة مجموعات الكربوكسي التي ادخلت علي مجموعة الهيدروكسيل للكيتوزان وذلك عن طريق التحليل العنصري و التحليل الطيفي باستخدام الأشعة تحت الحمراء. كما تم التحور الكيميائي للكربوكسي ميثيل كيتوزان عن طريق التطعيم باستخدام ثلاثة أنواع من مونوميرات الفينيل وهم: الاكريلونيتريل ، N-فينيل إيميدازول و ٤- فينيل بيريدين. و لقد درست العوامل المؤثرة علي عملية التطعيم مثل: تركيز المونومير، تركيز البادئ، درجة حرارة و زمن التفاعل. كما تم دراسة العوامل المؤثرة علي عملية التطعيم مثل النسبة المئوية لنواتج التطعيم ، النسبة المئوية للبوليمر المتماثل وبذلك فلقد تم تحديد الظروف المثلي لكل نظام علي حده. علاوة علي ذلك، وصفت خصائص البوليمرات المطعمة باستخدام التحليل الطيفي باستخدام الأشعة تحت الحمراء، الذوبانية، حيود الأشعة السينية، التحليل الوزني الحراري والميكروسكوب الماسح الالكتروني. كما تم اجراء بعض التطبيقات علي الكربوكسي ميثيل كيتوزان المطعم مثل: إمتصاص الصبغات المختلفة، معدل الانتفاش و امتصاص ايونات المعادن الثقيلة.

ولقد وجد ان التطعيم يزيد من الثبات الحراري للكربوكسي ميثيل كيتوزان وايضا يزيد من قدرته علي امتصاص الصبغات. كما اثبتت النتائج ان القدرة علي امتصاص ايونات المعادن تزداد بتحور مجموعات النيتريل الي الأميدوكزيم للكربوكسي ميثيل كيتوزان المطعم بالاكريلونيتريل. كما وجد ان نشاط الكربوكسي ميثيل كيتوزان كمضاد للميكروبات يتحسن بتطعيمه باستخدام بولي (N- فينيل اميدازول).

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الكربوكسي ميثيل كيتوزان، الاكريلونيتريل ، الاميدوكزيم ، ٤- فينيل بيريدين ، N-فينيل اميدازول، التطعيم ، امتصاص الصبغة ، الانتفاش ، نشاط المضاد للميكروبات ، امتصاص المعادن ، الثبات الحراري

التوقيع :

المشرفون:

(١) أ.د/ مجدى سبع وديد فرج

(٢) أ.د / نادية أحمد محمد أحمد

(٣) د/ ريهام رشاد محمد علي

يعتمد....

أ.د. محمد محمد شكري

رئيس مجلس الكيمياء

كلية العلوم- جامعه القاهرة

تم تحضير الكربوكسي ميثيل كيتوزان. تعين نسبة مجموعات الكربوكسي التي ادخلت علي مجموعة الهيدروكسيل وذلك عن طريق التحليل العنصري و التحليل الطيفي باستخدام الأشعة تحت الحمراء. التعديل الكيميائي للكربوكسي ميثيل كيتوزان عن طريق التطعيم باستخدام مونوميرات الفينيل وهم: الاكريلونيتريل ، ن-فينيل اميدازول و ٤- فينيل بيريدين.دُرست العوامل المثرة علي عملية التطعيم مثل: تركيز المونومير، تركيز البادئ،درجة حرارة و زمن التفاعل. عوامل التطعيم مثل النسبة النوية لنواتج التطعيم ، النسبة النوية لكفاءة التطعيم و النسبة النوية للبوليمر المتماثل تم حسابها. عينت الظروف المثلي لكل نظام علي حده. علاوة علي ذلك، وصفت خصائص البوليمرات المطعمة باستخدام التحليل الطيفي باستخدام الأشعة تحت الحمراء، الذوبانية، حيود الأشعة السينية، التحليل الوزني الحراري والميكروسكوب الماسح الالكتروني. تم اجراء بعض التطبيقات علي الكربوكسي ميثيل كيتوزان المطعم مثل: امتصاص الصبغة، الانتفاخ و امتصاص المعادن.

وجد ان التطعيم يزيد الثبات الحراري الكربوكسي ميثيل كيتوزان وقدرته علي امتصاص الصبغة. قدرته علي امتصاص المعادن تزداد بالأמידواكزيماشن للكربوكسي المطعم الاكريلونيتريل. وجد ان نشاط الكربوكسي ميثيل كيتوزان المضاد للميكروبات يتحسن بالتطعيم باستخدام ن- فينيل اميدازول.

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