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จุฬาลงกรณ์มหาวิทยาลัย

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PREPARATION OF SURFACE-CHARGED CHITOSAN FOR
SELECTIVE BIORESPONSES

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ศูนย์วิทยทรัพยากร
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for the Degree of Master of Science in Petrochemistry and Polymer Science

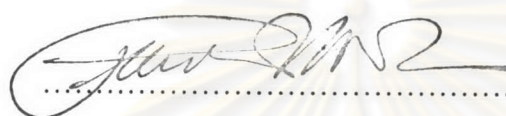
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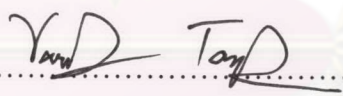
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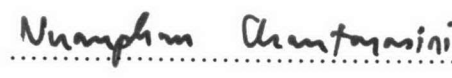
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เยวามาลย์ อังกิจไพฑูรย์: การเตรียมไคโตซานที่มีพื้นผิวเป็นประจุเพื่อการตอบสนองทางชีวภาพอย่างเลือกจำเพาะ (PREPARATION OF SURFACE-CHARGED CHITOSAN FOR SELECTIVE BIORESPONSES) อาจารย์ที่ปรึกษา: ผศ.ดร.วราวุฒิ ตั้งพสุธาตล; อาจารย์ที่ปรึกษาร่วม: ผศ.ดร. วิภาวี โฮვნัน; 65 หน้า ISBN 974-17-6713-7

พื้นผิวของฟิล์มไคโตซานถูกทำให้มีประจุบวกและลบด้วยวิธีการสองวิธี วิธีการแรกเกี่ยวข้องกับปฏิกิริยาระหว่างหมู่เอมิโนของไคโตซานกับเมทิลไอโอดิเด็คเกิดเป็นเกลือควอเทอร์นารีแอมโมเนียมแสดงประจุเป็นบวก วิธีที่สองเป็นการติดโมเลกุลที่มีประจุลบของหมู่ซัลโฟเนตด้วยการทำปฏิกิริยารีดักทีฟอัลคิลเลชันของหมู่เอมิโนด้วยเกลือของกรด 5-ฟอร์มิล-2-ฟิวแรนซัลโฟนิค ผลจากการวิเคราะห์โดยเอทีอาร์-เอฟทีไออาร์สเปกโทรสโกปี เอ็กซ์เรย์โฟโตอิเล็กตรอนสเปกโทรสโกปีและเซต้าโพเทนเทียล ช่วยยืนยันการเกิดเป็นหมู่ฟังก์ชันและประจุตามที่ต้องการ ผลจากค่ามุมสัมผัสของน้ำแสดงให้เห็นว่าฟิล์มที่ผ่านการดัดแปรนั้นมีความชอบน้ำมากกว่าฟิล์มไคโตซานเดิม โปรตีนชนิดต่างๆที่มีค่าไอโซอิเล็กทริกต่างกัน ได้แก่ อัลบูมิน ไฟบริโนเจน ไลโซไซม์ และไรโบนิวคลีเอส ถูกนำมาใช้ในการศึกษาการดูดซับโปรตีนบนพื้นผิวฟิล์มไคโตซานที่ผ่านการดัดแปรแล้ว ผลของการศึกษานี้แสดงให้เห็นว่าสามารถทำให้เกิดประจุบนพื้นผิวโดยปฏิกิริยาต่างวิถุภาคซึ่งประจูดังกล่าวมีผลกระทบต่อการศึกษาการดูดซับโปรตีน



หลักสูตร ปริญญาโทและวิทยาศาสตรมหาบัณฑิต ๒๕๓๖

สาขาวิชา ปริญญาโทและวิทยาศาสตรมหาบัณฑิต ๒๕๓๖

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Two methods were used to create positive and negative charges on chitosan films. The first method involves the reaction between amino groups ($-NH_2$) of chitosan with methyl iodide (MeI) to form positively-charged quaternary ammonium salts. The second method is to attach a molecule containing a negatively-charged sulfonate group by reductive alkylation of amino groups using 5-formyl-2-furan sulfonic acid (FFSA). Attenuated total reflectance infrared spectroscopy (ATR-IR), x-ray photoelectron spectroscopy (XPS) and zeta potential measurement confirmed the presence of the designated functional groups on the films and charge formation. Both modified films were more hydrophilic than the non-modified film, as determined by water contact angle measurement. Various proteins having different isoelectric point (pI); albumin, fibrinogen, lysozyme and RNase, were used for studies of protein adsorption. This study has demonstrated that it is conceivable to generate surface charges on chitosan which influence its response to protein adsorption by heterogeneous reactions.

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Field of study Petrochemistry and Polymer Science Advisor's signature *Varawut*

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LIST OF ABBREVIATIONS AND SYMBOLS

| | |
|----------|--|
| % DD | : Percent degree of deacetylation |
| QAC | : Quaternary ammonium chitosan |
| SFC | : <i>N</i> -sulfofurfuryl chitosan |
| NMR | : Nuclear magnetic resonance spectroscopy |
| ATR-FTIR | : Attenuated Total Reflectance-Fourier Transform Infrared Spectroscopy |
| XPS | : X-ray photoelectron spectroscopy |
| FFSA | : 5-Formyl-2-furan sulfonic acid, sodium salt |
| %DS | : Percent degree of substitution |
| PBS | : Phosphate buffer saline |
| BCA | : Bicinchoninic acid |
| BSA | : Bovine serum albumin |
| FIB | : Bovine serum fibrinogen |
| LYZ | : Lysozyme |
| RNase | : Ribonuclease |
| SDS | : Sodium dodecyl sulfate |
| °C | : Degree Celsius |
| h | : Hour |
| ml | : Milliliter |
| θ | : Angle of incidence |
| μ | : Micro |