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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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**FABRICATION OF CHITOSAN NANOFIBERS BY ELECTROSPINNING
TECHNIQUE FOR CELL IMMOBILIZATION**

Miss Prissadawan Chumanee

**A Thesis Submitted in Partial Fulfillment of the Requirements
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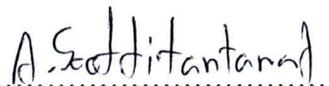
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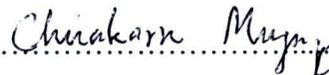
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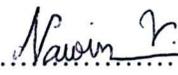

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ปริศณาวรรณ ชุมณี: การสร้างเส้นใยไคโตซานขนาดนาโนโดยเทคนิคการปั่นด้วยไฟฟ้า
สถิตย์เพื่อใช้ในการตรึงเซลล์ (FABRICATION OF CHITOSAN NANOFIBERS BY
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งานวิจัยนี้ได้ทำการศึกษาการสร้างเส้นใยไคโตซานขนาดนาโนด้วยเทคนิคการปั่นด้วยไฟฟ้า
สถิตย์โดย ซึ่งมีวัตถุประสงค์ในการศึกษาถึงความเป็นไปได้ของการสร้างเส้นใยไคโตซานบริสุทธิ์ขนาด
นาโนด้วยเทคนิคการปั่นด้วยไฟฟ้าสถิตย์รวมถึงการยึดติดและการมีชีวิตของเซลล์แบคทีเรียทั้งแบคทีเรีย
แกรมบวกและแบคทีเรียแกรมลบบนเส้นใยนาโนที่สร้างขึ้น โดยในส่วนของความสามารถในการขึ้นรูป
พบว่าสารละลายไคโตซานที่มีน้ำหนักโมเลกุล 100, 400, 760 kDa เพียงอย่างเดียวไม่สามารถปั่นเป็นเส้น
ใยได้แต่จะถูกฉีดออกมาเป็นหยดเท่านั้น ไคโตซานจะสามารถปั่นเป็นเส้นใยได้ก็ต่อเมื่อเติมพอลิไวนิล
แอลกอฮอล์เป็นสารช่วยการปั่นเส้นใยหรือการทำปฏิกิริยาไฮโดรไลซิสของไคโตซาน ในส่วนของการ
ตรึงเซลล์แบคทีเรียและความสามารถในการมีชีวิตอยู่นั้นพบว่าแบคทีเรียแกรมลบสามารถยึดติดและมี
การรอดชีวิตของเซลล์บนเส้นใยไคโตซานขนาดนาโนได้มากกว่าแบคทีเรียแกรมบวก จากการศึกษาการ
มีชีวิตของเซลล์แบคทีเรียด้วยเครื่องฟลูออเรสเซนซ์ไมโครสโคปีแสดงให้เห็นว่าการบ่มเชื้อเป็นเวลา 12
ชั่วโมงมีความเหมาะสมให้เซลล์แบคทีเรียรอดชีวิตบนพื้นผิวของไคโตซาน นอกจากนั้นการเพิ่มเวลา
ของปฏิกิริยาไฮโดรไลซิสของไคโตซานจะเพิ่มการยึดติดและความสามารถในการมีชีวิตของแบคทีเรีย
บนพื้นผิวไคโตซานด้วยบทบาทของปฏิกิริยาการกำจัดหมู่อะซิดิลและน้ำหนักโมเลกุลของไคโตซานที่
ลดลงในขณะที่เกิดปฏิกิริยาไฮโดรไลซิส นอกจากนั้นเมื่อเปรียบเทียบการยึดติดและการรอดชีวิตของเซลล์
แบคทีเรียบนไคโตซานในรูปแบบเส้นใยและฟิล์มไคโตซานพบว่าเส้นใยไคโตซานขนาดนาโนให้ผล
การทดลองที่ดีมากกว่าฟิล์มไคโตซาน

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PRISSADAWAN CHUMANEE: FABRICATION OF CHITOSAN NANOFIBERS BY ELECTROSPINNING TECHNIQUE FOR CELL IMMOBILIZATION. THESIS

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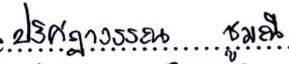
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In this study, chitosan nanofibers were fabricated by electrospinning technique. It is an objective of this research to investing the feasibility of pure chitosan nanofibers fabrication via the electrospinning technique and to investigate bacterial attachment and cells viability of Gram-positive *Brevibacillus agri* strain 13 and Gram-negative *Acinetobacter baylyi* strain GFJ2 on the electrospun nanofibers. The fabrication of pure chitosan nanofibers was found to be unsuccessful. Only sprayed droplets were obtained. In order to obtain nanofibers, either the addition of polyvinyl alcohol (PVA) as a spinning aid or the hydrolysis of chitosan is needed. Formability, morphology and size distribution of the electrospun nanofibers using various preparation conditions are reported. For the results of bacterial attachment and viability, it has been proven that attachment of Gram-negative bacteria on chitosan is more effective than Gram-positive bacteria. Fluorescence microscopy results showed the optimal of incubation time of bacteria to be 12 h to get the highest fraction of live cells on the chitosan surface. Increasing hydrolysis time results in increased cell attachment and viability on the surface by the role of deacetylation and molecular weight reduced by hydrolysis reaction. Moreover, the chitosan in nanofibers form shows better cell attachment than chitosan in the form of films.

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