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ของ โครงเลี้ยงเซลล์ที่ทำจากคอลลาเจนและโคโคซาน



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THE INFLUENCE OF MOLECULAR WEIGHT OF CHITOSAN ON PHYSICAL
AND BIOLOGICAL PROPERTIES OF COLLAGEN/CHITOSAN SCAFFOLDS



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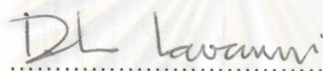
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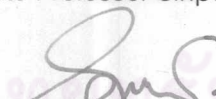
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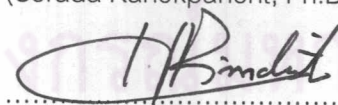

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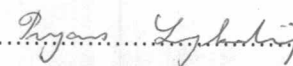
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ฉลองลาภ ตั้งศรีธราคุณ : อิทธิพลของมวลโมเลกุลของไคโตซานต่อสมบัติทางกายภาพและชีวภาพของโครงเลี้ยงเซลล์ที่ทำจากคอลลาเจนและไคโตซาน. (THE INFLUENCE OF MOLECULAR WEIGHT OF CHITOSAN ON PHYSICAL AND BIOLOGICAL PROPERTIES OF COLLAGEN/CHITOSAN SCAFFOLDS) อ. ที่ปรึกษา : รศ.ดร. ศิริพร ดำรงค์ศักดิ์กุล, อ. ที่ปรึกษาร่วม : ดร. ไศรดา กนกพานนท์, 148 หน้า. ISBN 974-53-2562-7.

พอลิเมอร์ชีวภาพผสมระหว่างคอลลาเจนและไคโตซานมีศักยภาพสำหรับนำมาผลิตเป็นโครงเลี้ยงเซลล์ที่มีความเข้ากันได้ทางชีวภาพ อย่างไรก็ตามความสัมพันธ์ระหว่างมวลโมเลกุลของไคโตซานกับสมบัติทางกายภาพและชีวภาพของโครงเลี้ยงเซลล์ที่ทำจากคอลลาเจนและไคโตซานยังไม่มีรายงานที่ชัดเจน ในงานวิจัยนี้จึงมุ่งเน้นที่จะศึกษาผลของมวลโมเลกุลของไคโตซานต่อสมบัติทางกายภาพและชีวภาพของโครงเลี้ยงเซลล์ที่ทำจากคอลลาเจนและไคโตซาน โดยโครงเลี้ยงเซลล์ที่ใช้ในการทดลองเตรียมโดยกระบวนการทำแห้งด้วยความเย็นของสารละลายผสมและเชื่อมโยงพันธะระหว่างสายไซโมเลกุลโดยการใช้ความร้อนภายใต้สภาวะสุญญากาศ โครงเลี้ยงเซลล์ถูกเตรียมโดยเปลี่ยนมวลโมเลกุลของไคโตซาน 4 ค่า (ในช่วง 4,800 ถึง 880,000) และสัปดาห์การผสม Fourier transform infrared (FT-IR) spectroscopy พิสูจน์ให้เห็นว่าอันตรกิริยาระหว่างคอลลาเจนและไคโตซานเป็นแบบกายภาพในทุกสัปดาห์การผสม โดยไม่เกิดปฏิกิริยาทางเคมีในระดับโมเลกุลจากการทดสอบค่ามอดูลัสของการกดทำให้ทราบว่าค่ามอดูลัสจะลดลงเมื่อสัดส่วนของไคโตซานเพิ่มขึ้น แต่สำหรับไคโตซานที่มีมวลโมเลกุลสูงจะให้ค่ามอดูลัสเพิ่มขึ้นที่สัปดาห์การผสมของไคโตซาน 30 เปอร์เซ็นต์ โครงเลี้ยงเซลล์ที่มีคอลลาเจนเป็นองค์ประกอบหลักจะมีสัปดาห์การบวมน้ำที่สภาวะสมดุลซึ่งมีค่าประมาณ 6-8 เท่าของน้ำหนักโครงเลี้ยงเซลล์แห้ง ในสารละลายบัฟเฟอร์ที่มีค่าความเป็นกรดต่าง 7.4 (เท่ากับค่าทางสรีรวิทยา) การทดสอบการย่อยสลายทางชีวภาพแสดงให้เห็นว่าการเติมไคโตซานโดยเฉพาะมวลโมเลกุลสูงทำให้ความสามารถในการย่อยสลายตัวของโครงเลี้ยงเซลล์ช้าลง การทดสอบการเพาะเลี้ยงเซลล์ผิวหนังชั้นในของหนูและของมนุษย์ พบว่าโครงเลี้ยงเซลล์ที่ทำจากคอลลาเจนและไคโตซานมวลโมเลกุลต่ำสามารถกระตุ้นการเจริญเติบโตของเซลล์ผิวหนังชั้นในอย่างมีประสิทธิภาพมากกว่าโครงเลี้ยงเซลล์ที่ทำจากคอลลาเจน และโครงเลี้ยงเซลล์ที่ทำจากคอลลาเจนและไคโตซานมวลโมเลกุลสูง โดยเฉพาะที่สัปดาห์การผสมของไคโตซาน 30 เปอร์เซ็นต์ ผลการทดลองแสดงถึงความเป็นไปได้อย่างยิ่งในการใช้พอลิเมอร์ชีวภาพผสมระหว่างคอลลาเจนและไคโตซานมวลโมเลกุลต่ำเป็นวัสดุชนิดใหม่ในงานวิศวกรรมเนื้อเยื่อผิวหนัง

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 สาขาวิชา.....วิศวกรรมเคมี.....ลายมือชื่ออาจารย์ที่ปรึกษา.....
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CHALONGLARP TANGSADTHAKUN : THE INFLUENCE OF MOLECULAR WEIGHT OF CHITOSAN ON PHYSICAL AND BIOLOGICAL PROPERTIES OF COLLAGEN/CHITOSAN SCAFFOLDS. THESIS ADVISOR : ASSOC.PROF. SIRIPORN DAMRONGSAKKUL, Ph.D., THESIS COADVISOR : SORADA KANOKPANONT, Ph.D., 148 pp. ISBN 974-53-2562-7.

Biopolymer blends between collagen and chitosan have good potential for production of biocompatible scaffolds. However, the relationship between the molecular weight of chitosan and its effect on physical and biological properties of collagen/chitosan scaffolds have not been clearly elucidated. This research aims to investigate the effects of molecular weight of chitosan on physical and biological properties of collagen/chitosan scaffolds. Porous scaffolds were fabricated by freeze drying solutions of collagen, chitosan, and collagen/chitosan blends and then crosslinked by dehydrothermal treatment (DHT). Various scaffolds were prepared using four chitosan samples with various molecular weights (M_w , 4.8k-880k) and blending compositions. Fourier transform infrared (FT-IR) spectroscopy proved that collagen/chitosan scaffolds in all blending compositions contained only physical but not chemical interaction in molecular level. The compressive modulus of scaffolds decreased with increasing the compositions of chitosan, but, for collagen blended with high molecular weight chitosan (880k), the compressive modulus increased, especially at blending composition of 30% chitosan. Equilibrium swelling ratios of approximately 6-8, carried out in phosphate buffered saline at physiological pH (7.4), were found in case of collagen dominate scaffolds. The lysozyme biodegradation test demonstrated that the presence of chitosan, especially the high molecular weight, could significantly prolong the biodegradation of collagen/chitosan scaffolds. *In vitro* culture of L929 mouse connective tissue fibroblasts and Detroit 551 human dermal fibroblasts evidenced that collagen scaffold with lower molecular weight chitosan was more effective to promote and accelerate cell proliferation than pure collagen and collagen/high molecular weight chitosan scaffolds, particularly for scaffolds containing 30% of chitosan. The results elucidated that the blends of collagen with low molecular weight chitosan have a high possibility to be applied as new materials for skin tissue engineering.

Department..... Chemical Engineering..... Student's signature..... *Tangsadthakun*
Field of study..... Chemical Engineering..... Advisor's signature..... *Siriporn*
Academic year...2005..... Co-advisor's signature..... *Sorada*

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