

**INFLUENCE OF SURFACE MORPHOLOGY
TO THE PROTEIN ADSORPTION ON POLYCAPROLACTONE FILM**




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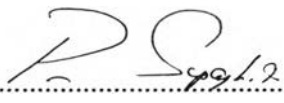
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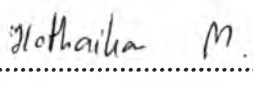
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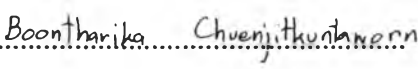

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ABSTRACT

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Keywords: Polycaprolactone/ Bovine serum albumin/ Surface morphology/ Protein adsorption

Protein adsorption is the first phenomena that would occur when the foreign materials are inserted into the body. The materials used in biomedical application can have different surface topology. It is important to know the effect of surface to protein adsorption. The main objectives of this study were to prepare the polycaprolactone (PCL) film of different surface topology and different degree of crystallinity. The protein adsorption on various surface characteristics was studied. Surface of polycaprolactone was made to have different topology by different phase separation using solvents of various solubility parameters. The solvents applied in this study were chloroform, acetone, tetrahydrofuran (THF) and ethanol. The degree of crystallinity was varied by different annealing time. Surface of polycaprolactone film could be modified for better protein adsorption by aminolysis, using 1,6-hexamethylenediamine (HMD). Then, the amino groups were activated by N,N'-disuccinimidyl carbonate (DSC) before the immobilization of protein called bovine serum albumin (BSA). The PCL films of different surface topology and the protein-adsorbed PCL films will be studied for their degree of crystallinity, hydrophobicity, functional group on the surface, surface roughness and cytotoxicity. It was found that degree of crystallinity does not affect the amount of protein adsorbed. The result from atomic force microscope (AFM) showed that the film casted from 40:60 (v/v) EtOH:THF had the roughest surface and the protein assay proved that it had significantly higher amount of protein adsorbed. The potential use of the film was evaluated by mouse-calvaria derived pre-osteoblastic cells (MC3T3-E1). The indirect cytotoxicity test showed that the materials were not harmful to the cells and cells proliferated best on the roughest surface.

บทคัดย่อ

วิภาวี ขามัสเสถียร : ผลกระทบจากสัณฐานพื้นผิวต่อการยึดเกาะของโปรตีนบนแผ่นฟิล์มพอลิคาโพรแลคโตน (Influence of Surface Morphology to the Protein Adsorption on Polycaprolactone Film) อ.ที่ปรึกษา : ศ. ดร. พิชญ์ ศุภผล 90 หน้า

การยึดเกาะของโปรตีนเป็นปรากฏการณ์แรกที่เกิดขึ้นเมื่อมีการใส่วัสดุอื่นเข้าไปภายในร่างกาย ในเมื่อวัสดุที่ใช้ในทางการแพทย์สามารถมีสภาพพื้นผิวที่แตกต่างกันดังนั้นการทราบถึงผลกระทบของพื้นผิวต่อการยึดเกาะของโปรตีนจึงเป็นสิ่งสำคัญ การศึกษานี้มีจุดประสงค์เพื่อเตรียมแผ่นฟิล์มพอลิคาโพรแลคโตนให้มีสัณฐานพื้นผิวและความเป็นผลึกที่แตกต่างกัน รวมถึงการตรวจสอบการยึดเกาะของโปรตีนบนพื้นผิวเหล่านั้น ผิวของแผ่นฟิล์มพอลิคาโพรแลคโตนสามารถถูกทำให้มีลักษณะที่แตกต่างกันได้โดยอาศัยหลักการแยกเฟสของตัวทำละลายซึ่งมีค่าดัชนีการละลายที่ไม่เหมือนกัน ตัวทำละลายที่ใช้ในการศึกษานี้ ได้แก่ กลอโรฟอร์ม อะซีโตน เตตระไฮโดรฟูราน (THF) และ เอทานอล การผันแปรความเป็นผลึกทำโดยการอบแผ่นฟิล์มที่เวลาแตกต่างกัน นอกจากนี้แล้วพื้นผิวของพอลิคาโพรแลคโตนยังสามารถถูกดัดแปรให้เกิดการยึดเกาะของโปรตีนที่ดีขึ้นได้ด้วยวิธีอะมิโนไลซิสโดยการทำปฏิกิริยากับเฮกซะเมทิลีนไดเอมีน (1,6-hexamethylenediamine) จากนั้นกลุ่มอะมิโนจะถูกกระตุ้นโดยไดซัคซินิมิดิลคาร์บอเนต (N,N'-disuccinimidyl carbonate) ก่อนที่จะใช้โปรตีนชนิดโบวิน เซรัม อัลบูมิน (bovine serum albumin) ไปยึดเกาะ แผ่นฟิล์มที่มีพื้นผิวและการเกาะของโปรตีนที่แตกต่างกันจะถูกศึกษาในแง่ของความเป็นผลึก การวัดมุมสัมผัสกับน้ำ หมู่ฟังก์ชันบนพื้นผิว ความขรุขระของพื้นผิว และความเป็นพิษต่อเซลล์ จากการศึกษาพบว่า ความแตกต่างความเป็นผลึกไม่ส่งผลกระทบต่อการยึดเกาะของโปรตีน และผลจากกล้องจุลทรรศน์พลังอะตอม (atomic force microscope) แสดงให้เห็นว่าแผ่นฟิล์มที่ใช้ 40:60 เอทานอล : เตตระไฮโดรฟูราน (โดยปริมาตร) เป็นตัวทำละลายมีพื้นผิวที่ขรุขระมากที่สุดและผลจากการวัดโปรตีนพิสูจน์ว่าแผ่นฟิล์มชนิดนี้มีจำนวนโปรตีนยึดเกาะมากที่สุด การทดสอบความสามารถในการเป็นวัสดุโครงสร้างสำหรับกระดูกทำโดยใช้เซลล์กระดูกหนู (MC3T3-E1) จากการศึกษาความเป็นพิษต่อเซลล์โดยอ้อมพบว่าแผ่นฟิล์มทุกชนิดไม่เป็นพิษต่อเซลล์และเซลล์เจริญเติบโตได้ดีที่สุดบนพื้นผิวที่มีความขรุขระ

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