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IMMOBILIZATION OF BIOMOLECULES ON SURFACE OF
POLYCAPROLACTONE FOR ARTIFICIAL SKIN APPLICATION

Miss Waradda Mattanavee

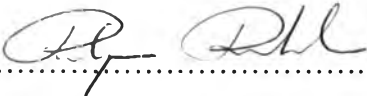
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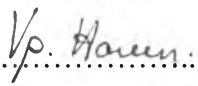
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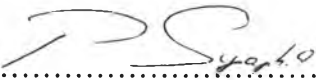
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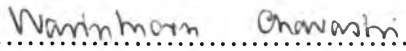
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เพื่อที่จะทำให้พอลิคาโพรแลกโตน (พีซีแอล) ซึ่งเป็นพอลิเอสเทอร์สายตรงสังเคราะห์ที่สามารถย่อยสลายได้ทางชีวภาพและมีสมบัติความเข้ากันได้กับเซลล์ของสิ่งมีชีวิต มีสมบัติเหมาะสมต่อการนำไปประยุกต์เป็นผิวหนังเทียม งานวิจัยนี้จึงมีเป้าหมายที่จะปรับปรุงสมบัติความชอบน้ำและการตอบสนองของเซลล์ของพีซีแอลโดยใช้การดัดแปรทางเคมีตามด้วยการตรึงสารชีวโมเลกุล ในขั้นแรกฟิล์มพีซีแอลผ่านการดัดแปรทางเคมีโดยการทำปฏิกิริยาอะมิโนไลซิสของ 1,6-เฮกซะเมทิลลินไดเอมีนหรือกราฟต์โคพอลิเมอร์เชนของกรดอะคริลิกเพื่อทำให้พื้นผิวของฟิล์มมีหมู่อะมิโนหรือคาร์บอกซิล ตามลำดับ จากนั้นจึงจะทำการตรึงด้วยคอลลาเจนและโคโคซานโดยใช้ระบบรีเอเจนต์คู่ควบของ ไคซัลซินิมิดิลคาร์บอนเนต (ดีเอสซี) หรือ 1-(3-ไดเมทิลอะมิโนโพรพิล)-3-เอทิลคาร์โบไดอิมด์ ไฮโดรคลอไรด์ (อีดีซีไอ) กับ เอ็น-ไฮดรอกซีซัลซินิไมด์ (เอ็นเอชเอส) ผลจากการวิเคราะห์ด้วยเอทีอาร์-เอฟทีไออาร์และการวัดมุมสัมผัสน้ำแสดงให้เห็นว่าฟิล์มพีซีแอลมีสมบัติชอบน้ำมากขึ้นหลังจากการดัดแปรทางเคมีและสามารถตรึงสารชีวโมเลกุลบนพื้นผิวฟิล์มพีซีแอลที่ผ่านการดัดแปรทางเคมีได้ ผลจากการศึกษาการตอบสนองในห้องปฏิบัติการของเซลล์เคราตินไซต์ (เอชอีเค001) และไฟโบรบลาสต์ (แอล929) ซึ่งแสดงในรูปของสัดส่วนการยึดเกาะและการเพิ่มจำนวนของเซลล์ พิสูจน์ให้เห็นว่าการเติมหมู่ที่ชอบน้ำตลอดจนการตรึงสารชีวโมเลกุลลงไปนั้น ช่วยปรับปรุงความเข้ากันได้กับเซลล์ของฟิล์มพีซีแอลดั้งเดิมได้เป็นอย่างดี ทั้งนี้ประสิทธิภาพในการปรับปรุงจะขึ้นอยู่กับความหนาแน่นและชนิดของสารชีวโมเลกุลที่ทำการตรึงด้วย

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ON SURFACE OF POLYCAPROLACTONE FOR ARTIFICIAL SKIN
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In order to make polycaprolactone (PCL), a biocompatible and biodegradable synthetic aliphatic polyester, more favorable for artificial skin application, this research aims to increase hydrophilicity as well as to improve cellular responses of PCL by chemical modification followed by immobilization of biomolecules. PCL film was first chemically modified by aminolysis of 1,6-hexamethylenediamine or graft copolymerization of acrylic acid (AA) to introduce amino or carboxyl groups, respectively, on its surface. The immobilization of collagen and chitosan was then carried out by using disuccinimidylcarbonate (DSC) or 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (EDCI)/*N*-hydroxysuccinimide (NHS), as a coupling agent. Data from ATR-FTIR analysis and water contact angle measurements indicated that PCL film became more hydrophilic after chemical modification and the immobilization of biomolecules on the surface-modified PCL film was successful. *In vitro* responses of keratinocyte (HEK001) and fibroblast (L929) cells expressed in terms of adhesion and proliferation ratios proved that introducing hydrophilic groups and further immobilizing with biomolecules can markedly improve cytocompatibility of the virgin PCL films. The degree of improvement depended upon the density and the type of immobilized biomolecules.

Field of study Petrochemistry and Polymer Science Student's signature Waradda Mattanavee
Academic year 2005 Advisor's signature Vp. Hoven
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LIST OF ABBREVIATION

AA	: Acrylic acid
Abs	: Absorbance
ATR-FTIR	: Attenuated Total Reflectance-Fourier Transform Infrared Spectroscopy
DMSO	: Dimethylsulfoxide
DSC	: <i>N, N'</i> -Disuccinimidyl carbonate
ECM	: Extracellular matrix
EDCI	: 1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride
FBS	: Fetal bovine serum
HEK001	: Keratinocyte Cell
IPA	: Isopropanol
L929	: Fibroblast Cell
MTT	: 3-(4,5-dimethyl-thiazol-2-yl)-2,5-diphenyl tetrazolium bromide
NHS	: <i>N</i> -hydroxysuccinimide
OD	: Optical Density
PBS	: Phosphate buffer saline
PCL	: Polycaprolactone
RPMI	: Roswell Park Memorial Institute
TCPS	: Tissue culture polystyrene
XPS	: X-ray photoelectron spectroscopy
θ_A	: Advancing contact angle
θ_R	: Receding contact angle