


**ANTIBACTERIAL AND ANTI-INFLAMMATORY BIOCOMPATIBLE
POLYMERS FOR WOUND CARE**

Thitikan Khampieng

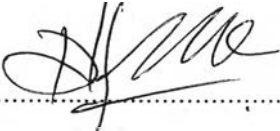
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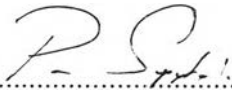
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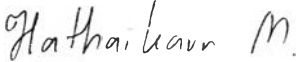
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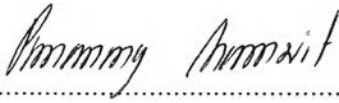

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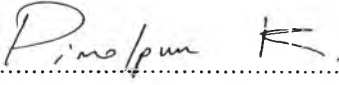
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ABSTRACT

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The application of a wound care material has been practiced in order to protect the wound from environments as well as to absorb exudate, reduce infections, and reduce inflammation, resulting in the promotion wound healing. In this work, three types of active wound materials are produced. They are silver nanoparticles-embedded poly(vinyl pyrrolidone) hydrogels prepared by gamma irradiation synthesis, doxycycline hyclate loaded-poly(acrylic acid) nanofiber mats fabricated by electrospinning technique, and silk sericin-alginate nanoparticles topical gel obtained by emulsification with internal gelation methods. As-loaded silver nanoparticles and doxycycline hyclate are effective broad-spectrum antibacterial agents. While as-loaded silk sericin is natural protein provides antioxidant, anti-wrinkle, cell promotion, and anti-inflammation. Consequently these as-prepared wound materials possess antibacterial activity or anti-inflammatory properties suitable to use as bio-interactive materials that can facilitate the wound healing process. Physical properties, antibacterial properties, the released characteristic of the active substances, cytotoxicity, *in vivo* wound healing tests of silver nanoparticles-embedded poly(vinyl pyrrolidone) hydrogels, and *in vivo* anti-inflammatory effect of silk sericin-alginate nanoparticles gel are all evaluated in the current study.

บทคัดย่อ

รศ.กานต์ คำเปียง : พอลิเมอร์ชีวภาพที่มีฤทธิ์ต้านเชื้อแบคทีเรียและด้านการอักเสบเพื่อการดูแลบาดแผล (Antibacterial and Anti-inflammatory Biocompatible Polymers for Wound Care) อ. ที่ปรึกษา: ศ.ดร. พิชญ์ สุภผล 99 หน้า

การใช้วัสดุสำหรับรักษาแผลมีจุดประสงค์เพื่อป้องกันแผลจากสภาพแวดล้อมภายนอก, ลดระดับของเหลวส่วนเกินจากบาดแผล, ลดการติดเชื้อ, และลดการอักเสบ ซึ่งส่งผลให้การรักษาแผลดีขึ้น ในงานนี้ได้ศึกษาการเตรียมวัสดุสำหรับรักษาแผลสามประเภท ได้แก่ แผ่นพอลิไวนิลไพโรลิโดนไฮโดรเจลที่มีอนุภาคเงินนาโนผสมอยู่ซึ่งเตรียมด้วยวิธีการฉายรังสีแกมมา, แผ่นเส้นใยนาโนจากพอลิอะคริลิกแอซิดที่ผสมยาดอกซีไซคลิน ไฮเครทซึ่งเตรียมด้วยวิธีการปั่นเส้นใยด้วยไฟฟ้าสถิต, และเจลที่ผสมอนุภาคนาโนซิริซินและอัลจินตซึ่งเตรียมด้วยวิธีการอิมัลชันร่วมกับการเกิดเจลภายใน อนุภาคเงินและดอกซีไซคลิน ไฮเครทที่มีอยู่ในวัสดุสำหรับรักษาแผลเหล่านี้มีฤทธิ์ในการยับยั้งเชื้อแบคทีเรีย ส่วนซิริซินจากไหมเป็นโพรตีนธรรมชาติที่มีคุณสมบัติในการต้านอนุมูลอิสระ, ต่อต้านริ้วรอย, ช่วยในการเจริญของเซลล์ และป้องกันการอักเสบ ดังนั้นวัสดุปิดแผลที่มีสารเหล่านี้จึงมีคุณสมบัติช่วยต่อต้านเชื้อแบคทีเรีย และด้านการอักเสบซึ่งเหมาะสมอย่างยิ่งในการนำไปประยุกต์ใช้เป็นวัสดุรักษาแผลชนิดใหม่ที่มีส่วนร่วมอย่างมากในการช่วยส่งเสริมการหายของแผล ในงานวิจัยนี้ได้ศึกษาลักษณะพื้นฐานวิทยา, ความสามารถในการยับยั้งเชื้อแบคทีเรีย, การปลดปล่อยสารสำคัญออกจากวัสดุปิดแผล, การทดสอบความเป็นพิษต่อเซลล์ผิวหนังมนุษย์, ประเมินความสามารถในการรักษาบาดแผลของแผ่นพอลิไวนิลไพโรลิโดนไฮโดรเจลที่มีอนุภาคเงินนาโนผสมอยู่ในสัตว์ทดลอง รวมถึงความสามารถในการยับยั้งการอักเสบของเจลที่ผสมอนุภาคนาโนซิริซินและอัลจินตอีกด้วย

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ABBREVIATIONS

AAS	Atomic absorption spectroscope
ATP	Adenosine triphosphate
CFU	Colony forming unit
DMEM	Dulbecco's modified Eagle's medium
DMSO	Dimethyl sulfoxide
DNA	Deoxyribonucleic acid
DOXY-h	Doxycycline hyclate
EDX	Energy-dispersive X-ray
EDTA	Ethylenediaminetetraacetic acid
FBS	Fetal bovine serum
FTIR	Fourier transform infrared
HATR	Horizontal attenuated total reflectance
MMP	Matrix metalloproteinase
MTT	3-(4,5-Dimethyl-2-thiazolyl)-2, 5-diphenyl-tetrazolium bromide
nAg	Silver nanoparticles
PAA	Poly(acrylic acid)
PBS	Phosphate buffer saline
PVP	Poly(vinyl pyrrolidone)
SBF	Simulated body fluid
SEI	Secondary electron image
SEM	Scanning electron microscopy
SFM	Serum-free medium
SS	Silk sericin
TEM	Transmission electron microscope
UV-VIS	UV-visible spectrophotometer
WVTR	Water vapor transmission rate