

**DEVELOPMENT OF POROUS SUPPORTING FABRIC-EMBEDDED  
BACTERIAL CELLULOSE COMPOSITES FOR WOUND DRESSING  
APPLICATIONS**

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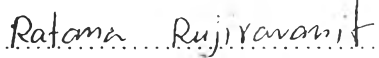
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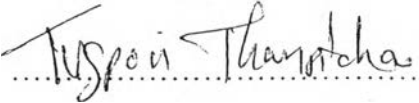
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## ABSTRACT

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A bacterial cellulose (BC) pellicle is a polysaccharide produced by *Acetobacter xylinum*. BC pellicles have many advantages such as hydrophilicity, ultrafine 3D network structure, high purity, high water absorption capacity, in addition to the never dried state of a hydrogel. Accordingly, BC pellicles are a good candidate for being used as a wound dressing material because it can provide a moist wound environment, promote the wound healing process, and has excellent molding to all facial body contours. However, in a large scale production of BC pellicles, damage from tearing of BC pellicle may occur during cultivation, sterilization, and packing into packaging. In order to reinforce BC pellicles, BC composites consisting of fabric embedded in the BC pellicles were fabricated. Cotton, linen, filter cloth, muslin, shefong (polyester) and nylon mesh were used to investigate the effect of the types of fabrics on mechanical properties, morphology, water absorption capacity, and water vapor transmission rate of the composites. In addition, the surface of the fabrics was modified by dielectric barrier discharge (DBD) plasma treatment before cultivation in culture medium containing *Acetobacter xylinum*. By applying DBD plasma treatment, hydrophilicity, and surface roughness of the fabrics could be enhanced. The effect of DBD plasma treatment on production yield, change in chemical structure of the plasma-treated fabrics, morphology, mechanical properties, water absorption, and water vapor transmission rate of the BC composites was examined.

## บทคัดย่อ

ณิชาภัทร์ บุญยืน : การพัฒนาวัสดุคอมโพสิตที่เตรียมจากแบคทีเรียเซลลูโลสและวัสดุสิ่งทอที่มีรูพรุนเพื่อใช้เป็นวัสดุปิดแผล (Development of Porous Supporting Fabric-embedded Bacterial Cellulose Composites for Wound Dressing Applications) อ. ที่ปรึกษา : รศ.ดร. รัตนา รุจิรวนิช 100 หน้า

แบคทีเรียเซลลูโลสคือเส้นใยเซลลูโลสบริสุทธิ์ที่สังเคราะห์ขึ้นโดยกระบวนการเมตาบอลิซึมของแบคทีเรีย *Acetobacter xylinum* ซึ่งเป็นกระบวนการสังเคราะห์ทางชีวภาพ แบคทีเรียเซลลูโลสมีข้อดีหลายประการคือ มีความมีขั้วสูง ความแข็งแรง โครงสร้างเส้นใยแบบสามมิติ ไม่เป็นพิษสามารถเข้ากับเซลล์ได้ดี สามารถดูดซับน้ำได้มาก และมีความบริสุทธิ์สูง นอกจากนี้เส้นใยแบคทีเรียเซลลูโลสถูกผลิตออกมาในรูปของวัสดุไฮโดรเจล ซึ่งเหมาะสมในการประยุกต์ใช้เป็นวัสดุปิดแผลเนื่องจากสมบัติไฮโดรเจลของแบคทีเรียเซลลูโลสจะสามารถรักษาภาวะความชุ่มชื้นของบาดแผลได้ ซึ่งจะช่วยให้กระบวนการสมานแผลเป็นไปได้เร็วขึ้น ทั้งยังสามารถดูดซับของเหลวจากแผลได้มาก ตลอดจนการถ่ายเทอากาศบริเวณบาดแผลได้ดี และลอกออกจากบาดแผลได้ง่ายโดยที่ไม่เกิดความเจ็บปวดและไม่ทำลายเนื้อเยื่อที่สร้างขึ้นใหม่ โดยเฉพาะอย่างยิ่งลดโอกาสในการเกิดแผลเป็น ในงานวิจัยนี้มีเป้าหมายที่จะพัฒนาวัสดุปิดแผลจากแบคทีเรียเซลลูโลสคอมโพสิต ซึ่งเป็นวัสดุคอมโพสิตที่เตรียมจากแบคทีเรียเซลลูโลสและวัสดุสิ่งทอที่มีรูพรุน (Porous supporting fabric) ได้แก่ ผ้าคอตตอน ผ้าฝ้ายลินิน ผ้าลินิน ตาข่ายไนลอน ผ้าพอลิเอสเตอร์ (ชีฟอง) และผ้าขาวบาง ที่ถูกปรับสภาพพื้นผิวของเส้นใยด้วยเทคนิค Dielectric barrier discharge plasma (DBD plasma) ซึ่งเทคนิค DBD plasma จะช่วยเพิ่มความขรุขระพื้นที่ผิว และความมีขั้วให้กับพื้นผิวเส้นใยของวัสดุสิ่งทอที่มีรูพรุน เพื่อเพิ่มคุณสมบัติในการเกาะติดของเซลล์แบคทีเรีย (Cell attachment) ซึ่งเป็นผลดีในการสังเคราะห์แบคทีเรียเซลลูโลสเคลือบบนวัสดุสิ่งทอที่มีรูพรุนเพื่อผลิตเป็นแผ่นแบคทีเรียเซลลูโลสคอมโพสิตที่มีความแข็งแรงทนต่อการฉีกขาดได้ดีกว่าแผ่นแบคทีเรียเซลลูโลสบริสุทธิ์ วัสดุคอมโพสิตที่ได้จะถูกนำไปพิสูจน์เอกลักษณ์ ได้แก่ โครงสร้างทางเคมี ลักษณะสัณฐานวิทยา ความสามารถในการดูดซับน้ำ ความสามารถในการซึมผ่านของไอน้ำ คุณสมบัติเชิงกล และการรักษาบาดแผลในสัตว์ทดลอง

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