

**SILVER COATING ON WOVEN PET SURFACE MODIFIED BY USING
DBD PLASMA TECHNIQUE FOR ANTIMICROBIAL PROPERTY
IMPROVEMENT**



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สุรกรีก อ่อนสุระทุม : การเคลือบโลหะเงินบนพื้นผิวของผ้าโพลีเอททิลีนทอรูปทาลาเลทที่ถูกเปลี่ยนแปลงด้วยเทคนิคพลาสมาแบบไดอิเล็กทริกแบริเออร์ดีสซาร์จ เพื่อเพิ่มคุณสมบัติการป้องกันแบคทีเรีย (Silver Coating on Woven PET Surface Modified by Using DBD Plasma Technique for Antimicrobial Property Improvement) อ.ที่ปรึกษา : รศ. ดร.รัตนา รุจิรวนิช รศ. ดร.สุเมธ ชวเดช ดร.ธรรมบุญ ศรีทะวงศ์ และ ศ.ดร.เชอิจิ โทคุระ 90 หน้า

งานวิจัยนี้เป็นการศึกษาการเปลี่ยนแปลงโครงสร้างพื้นผิวของผ้าโพลีเอททิลีนทอรูปทาลาเลทเพื่อเพิ่มคุณสมบัติการดูดซับน้ำ ภายใต้สภาวะพลาสมาแบบไดอิเล็กทริกแบริเออร์ดีสซาร์จ ซึ่งทำการศึกษาผลกระทบของตัวแปรต่างๆ (ระยะห่างระหว่างแผ่นอิเล็กโทรดและความต่างศักย์ไฟฟ้า) และผลกระทบของก๊าซชนิดต่างๆ (ออกซิเจน อาร์กอน อากาศและไนโตรเจน) ที่มีผลต่อการเปลี่ยนแปลงโครงสร้างของผ้าโพลีเอททิลีนทอรูปทาลาเลทให้มีคุณสมบัติการดูดซับน้ำได้ดีขึ้น จากการศึกษาพบว่า การลดระยะห่างระหว่างแผ่นอิเล็กโทรดและการเพิ่มความต่างศักย์ไฟฟ้าให้แก่ระบบทำให้สนามไฟฟ้าเพิ่มขึ้น (ฟลักซ์ของพลาสมาเกิดเพิ่มขึ้น) ซึ่งมีผลต่อการเพิ่มคุณสมบัติการดูดซับน้ำของผ้าโพลีเอททิลีนทอรูปทาลาเลทได้ดีขึ้นจากการตรวจสอบด้วยวิธีการดูดซับน้ำ (wick ability measurement) จากการตรวจสอบด้วยเทคนิค X-ray photoelectron spectroscopy (XPS) พบว่ามีหมู่ฟังก์ชัน $O=C-O$ และ $C-O$ บนพื้นผิวของผ้าโพลีเอททิลีนทอรูปทาลาเลทเกิดขึ้น ปริมาณของหมู่ฟังก์ชันดังกล่าวยังขึ้นอยู่กับชนิดของก๊าซที่อยู่ภายในเครื่องปฏิกรณ์เคมีอีกด้วย โดยอากาศบริสุทธิ์มีผลทำให้เกิดหมู่ฟังก์ชันดังกล่าวมากที่สุด รองลงมาคือ ออกซิเจน อาร์กอน และไนโตรเจนตามลำดับ ซึ่งมีผลสอดคล้องกับผลที่ได้จากการตรวจสอบการดูดซับน้ำ (wickability measurement) และหลังจากการเปลี่ยนแปลงโครงสร้างของผ้าโพลีเอททิลีนทอรูปทาลาเลทให้มีคุณสมบัติการดูดซับน้ำเพิ่มขึ้นแล้ว ได้ทำการเคลือบโลหะเงินโดยจุ่มผ้าโพลีเอททิลีนทอรูปทาลาเลทลงในสารละลายโลหะเงินเพื่อเพิ่มคุณสมบัติการป้องกันแบคทีเรีย จากผลการทดสอบการป้องกันแบคทีเรียพบว่าผ้าโพลีเอททิลีนทอรูปทาลาเลทที่ผ่านการเปลี่ยนแปลงโครงสร้างด้วยพลาสมาและเคลือบด้วยโลหะเงินแล้วมีประสิทธิภาพในการยับยั้งแบคทีเรียชนิด *E. coli* และ *S. aureus* ได้ดีมาก

ABSTRACT

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Property Improvement

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In this study, the hydrophilic improvement of a woven PET surface was accomplished by a plasma technique. The woven PET surface was plasma-treated by dielectric barrier discharge (DBD) under various operating parameters (gap distance and applied voltage) and various gases (O₂, N₂, Ar, and air) in order to improve the hydrophilicity of the woven PET surface. It was experimentally found that a decrease in gap distance and an increase in applied voltage increased the electric field strength, leading to more hydrophilicity of the PET surface characterized by wickability measurement. XPS analysis was carried out to identify functional groups on the polymer surface, such as O=C-O and C-O. The amount of such functional groups depended on the type of gas fed into the system. The air gas provided the largest amount of functional groups, while O₂, Ar, and N₂ provided less amounts, in that order, which agreed well with the wickability results. After the plasma treatment, the woven PET fabric was coated with silver using a silver nitrate solution in order to introduce the antimicrobial property. The woven PET fabric coated with silver particles exhibited good antimicrobial activity against *E.coli* and *S.aureus*.

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