

**PREPARATION OF ZINC OXIDE COATED POLYPROPYLENE FILM BY
DBD PLASMA TREATMENT FOR ANTIBACTERIAL IMPROVEMENT**



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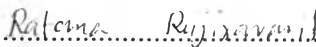
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ABSTRACT

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Generally, the aim of using food packaging is to preserve food products. However, microbial contamination is able to cause food deterioration. Therefore, the antimicrobial substances are often incorporated into packaging materials. In this work, zinc oxide (ZnO) coated polypropylene (PP) film was prepared with the aid of dielectric barrier discharge (DBD) plasma treatment. The surface hydrophilicity of PP film was increased after DBD plasma treatment due to the presence of oxygen-containing functional groups on the plasma-treated PP surface. In addition, the surface roughness of the plasma-treated PP film increased with increasing treatment time. The DBD plasma treatment did not affect the mechanical properties of the PP film. The optimum DBD plasma treatment time was 10 s. The plasma-treated PP film was further immersed in zinc nitrate solution before being converted to zinc oxide particles by reacting with sodium hydroxide. The highest amount of zinc oxide on PP film was 0.26 wt.%. The ZnO-loaded plasma-treated PP film possessed high antibacterial activity against both gram-negative *Escherichia coli* and gram-positive *Staphylococcus aureus*.

บทคัดย่อ

สุทธิดา ภัยสุญสิน : การเคลือบซิงค์ออกไซด์บนพื้นผิวแผ่นพอลิพรอพิลีนฟิล์มที่ถูกดัดแปลงด้วยเทคนิคพลาสมาแบบไดอิเล็กทริกแบริเออร์ดีสชาร์จเพื่อเพิ่มคุณสมบัติการต้านเชื้อแบคทีเรีย (Preparation of Zinc Oxide Coated Polypropylene Film by DBD Plasma Treatment for Antibacterial Improvement) อ.ที่ปรึกษา : รศ. ดร.รัตนารุจิรวนิช 61 หน้า

ในงานวิจัยนี้ซิงค์ออกไซด์ถูกเคลือบบนพื้นผิวแผ่นพอลิพรอพิลีนฟิล์มที่ถูกดัดแปลงด้วยเทคนิคพลาสมาแบบไดอิเล็กทริกแบริเออร์ดีสชาร์จ พบว่าคุณสมบัติในการดูดซับน้ำ (Hydrophilicity) บนพื้นผิวมีมากขึ้นหลังจากพอลิพรอพิลีนฟิล์มผ่านพลาสมา เนื่องจากพลาสมาทำให้เกิดหมู่ฟังก์ชันที่มีขั้ว เช่น C-OH, C=O, และ O-C=O บนพื้นผิวของพอลิพรอพิลีนฟิล์ม นอกจากนี้พลาสมายังส่งผลต่อความขรุขระของแผ่นฟิล์มกล่าวคือหลังผ่านพลาสมา แผ่นพอลิพรอพิลีนฟิล์มมีความขรุขระมากขึ้น แต่ไม่กระทบต่อคุณสมบัติเชิงกลของแผ่นฟิล์ม เวลาที่เหมาะสมสำหรับการใช้พลาสมาในการปรับปรุงพื้นผิวของพอลิพรอพิลีนฟิล์มอยู่ที่ 10 วินาที หลังจากนั้นแผ่นฟิล์มที่ถูกปรับปรุงพื้นผิวด้วยพลาสมาจะนำไปใส่ลงในสารละลายซิงค์ไอออนก่อนจะถูกเปลี่ยนเป็นซิงค์ออกไซด์ด้วยสารละลายโซเดียมไฮดรอกไซด์ พบว่าปริมาณสูงสุดของซิงค์ออกไซด์ที่เคลือบอยู่บนผิวของพอลิพรอพิลีนฟิล์มที่ถูกปรับปรุงพื้นผิวด้วยไดอิเล็กทริกแบริเออร์ดีสชาร์จมีค่าเท่ากับ 0.26 wt.% ในการทดสอบคุณสมบัติการยับยั้งแบคทีเรียพบว่าแผ่นฟิล์มที่ผ่านการดัดแปลงพื้นผิวด้วยพลาสมาและเคลือบด้วยซิงค์ออกไซด์แล้ว จะมีประสิทธิภาพในการต้านเชื้อแบคทีเรียชนิด *Escherichia coli* และ *Staphylococcus aureus* ได้อย่างยอดเยี่ยม

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