

**BIO-ADDITIVE CHITOSAN FOR SURFACE FUNCTIONALIZATION AND
ANTIOXIDANT COMPOUNDING OF VALUE-ADDED
COMMODITY POLYMER**



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ABSTRACT

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The present dissertation proposes two approaches to develop bio-additive of chitosan, i.e. (i) chitosan bio additive for surface functionalization onto polymer, and (ii) chitosan bio-additive based antioxidant for commodity polymer. In the case of (i), surface functionalization of polyethylene with chitosan is successful via chitosan aqueous solution prepared by chitosan-HOBT. Chitosan grafted onto polyethylene film is achieved by γ -ray irradiation. Copper ion adsorption on polyethylene-graft-chitosan clarifies the specific property of chitosan in chelating of copper ion resulting in new product manifesting the properties of both polyethylene and chitosan. For (ii), bio-additive based antioxidant chitosan is successfully prepared by conjugating gallic acid onto chitosan to achieve chitosan-based antioxidant (chitosan-GA) in water based system. The development of bio-additive chitosan-based antioxidant for compounding with commodity polymer is also prepared by conjugating chitosan with both gallic acid and deoxycholic acid. The electron paramagnetic resonance (EPR) is used to clarify the antioxidant ability of chitosan derivatives. The derivative obtained shows the specific antioxidant ability via galloylate group.

บทคัดย่อ

วรรณวิมล ปาสาณพันธ์ : ไคโตซานสารเติมแต่งทางชีวภาพ สำหรับใช้เติมกลไกบนพื้นผิว และใช้เป็นสารต้านอนุมูลอิสระให้กับวัสดุพอลิเมอร์ (Bio-additive Chitosan for Surface Fuctionalization and Antioxidant Compounding of Value-Added Commodity Polymer) อ. ที่ปรึกษา : รองศาสตราจารย์ ดร. สุวบุญ จิระกาญจชัย 110 หน้า

วิทยานิพนธ์นี้เสนอสองแนวทางในการพัฒนาไคโตซานเพื่อเป็นสารเติมแต่งชีวภาพ ได้แก่ (1) สารเติมแต่งไคโตซานเพื่อการเติมกลไกลงบนพื้นผิวของพอลิเมอร์ และ (2) สารเติมแต่งอนุพันธ์ไคโตซานเพื่อเป็นสารต่อต้านอนุมูลอิสระสำหรับการเติมแต่งในวัสดุพอลิเมอร์ สำหรับกรณี (1) การเติมกลไกของไคโตซานลงบนผิวพอลิเอททีลีน สามารถเตรียมได้โดยใช้สารละลายไคโตซานในระบบน้ำ คือ ไคโตซาน-ไฮดรอกซีเบนโซไตรเอโซล ไคโตซานสามารถถูกติดบนผิวพอลิเอททีลีน โดยการเหนี่ยวนำด้วยรังสีแกมมา ไอออนทองแดงสามารถถูกดูดซับบนผิวพอลิเอททีลีนได้โดยผ่านกลไกของไคโตซาน ผลดังกล่าวแสดงให้เห็นถึงคุณสมบัติจำเพาะของไคโตซานในการตรึงไอออนทองแดงส่งผลให้ได้วัสดุใหม่ที่มีคุณสมบัติร่วมกันของพอลิเอททีลีนและไคโตซาน ในกรณี (2) สารเติมแต่งทางชีวภาพไคโตซานสำหรับต่อต้านอนุมูลอิสระ สามารถเตรียมได้โดยการติดหมู่กลูตลิก แอซิด ลงบนไคโตซาน เพื่อเป็นสารเติมแต่งสำหรับต่อต้านอนุมูลอิสระในระบบน้ำ นอกจากนี้การพัฒนาไคโตซานเพื่อเป็นสารเติมแต่งสำหรับคอมปาวด์ในพอลิเมอร์ทั่วไป สามารถเตรียมด้วยการติดทั้งหมู่กลูตลิก แอซิด และ หมู่ไดออกซีกลูตลิก แอซิด ลงบนไคโตซาน เทคนิคอิเล็กตรอนพาราแมกเนติกเรโซแนนซ์ถูกนำมาใช้เพื่อศึกษาความสามารถในการเป็นสารต้านอนุมูลอิสระของอนุพันธ์ของไคโตซาน ผลการศึกษาแสดงให้เห็นว่าอนุพันธ์ของไคโตซานแสดงคุณสมบัติต่อต้านอนุมูลอิสระโดยผ่านกลไกของหมู่กลูตลิกบนไคโตซาน

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