

**RESEARCH AND DEVELOPMENT OF NOVEL COPOLYMERS OF  
POLYCARBONATE/POLYLACTIC ACID**

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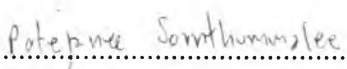
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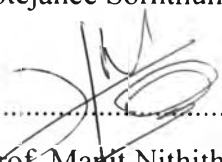
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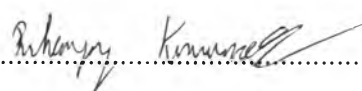
  
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## ABSTRACT

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The impact strength and heat distortion temperature (HDT) of Polycarbonate (PC)/Polylactic acid (PLA) blends was developed by adding reactive compatibilizers. Polycarbonate (PC) is an engineering thermoplastic which has high impact strength and heat resistance. However, because of environmental concern, the consumption of bio-based polymer is rising up for recent years. PLA is a bio-based polymer with high strength. Blending PLA with PC is an efficient way due to accepted mechanical properties of PLA. PC/PLA blends were immiscible that caused in poor mechanical properties especially impact strength and HDT. In this study, Dibutyltin oxide (DBTO), Poly(ethylene-co-acrylic acid) (EAA), Lysine triisocyanate (LTI), and Poly(styrene-g-glycidyl methacrylate)(PS-g-GMA) were used as the added compatibilizer to improve the impact strength and heat resistance of PC/PLA blends. All components were melt-mixed in a twin screw extruder by varying the types and content of the compatibilizers. Morphology and other properties such as physical, thermal and mechanical properties of blends were investigated. PC70PS-g-GMA0.5 is the best formulas because its HDT is high closed to neat PC. PC70PS-g-GMA0.5 has relatively high mechanical properties especially impact strength. Finally, Benchmarking of PC70PS-g-GMA0.5 with previous work and commercially available PC/PLA blend exhibit that PC70PS-g-GMA0.5 provided higher HDT than the commercially available product.

## บทคัดย่อ

สุปรินญา ทิศสิน่า : การคิดค้นและพัฒนาโคพอลิเมอร์ชนิดใหม่ของพอลิคาร์บอเนตและพอลิแลคติก แอซิด (Research and Development of Novel Copolymers of PC/PLA)  
 อ.ที่ปรึกษา : ผศ. ดร.หทัยกานต์ มั่นสปียะ และ ดร. พงษ์ ศรีธรรมมาลี 135 หน้า

ความทนทานต่อแรงกระแทกและอุณหภูมิการคงรูปทางความร้อนของพอลิเมอร์ผสมระหว่างพอลิคาร์บอเนตและพอลิแลคติก แอซิดได้รับการพัฒนาโดยการใส่ตัวเชื่อมประสานแบบเกิดปฏิกิริยาเข้าไป พอลิคาร์บอเนตเป็นเทอร์โมพลาสติกเชิงวิศวกรรมที่มีความทนทานต่อแรงกระแทกและความทนทานต่อความร้อนสูง อย่างไรก็ตามเนื่องจากความกังวลเกี่ยวกับสิ่งแวดล้อมส่งผลให้ความต้องการของพอลิเมอร์ชีวภาพเพิ่มขึ้นอย่างต่อเนื่องในช่วงเวลาไม่กี่ปีที่ผ่านมา ซึ่งพอลิแลคติก แอซิดเป็นหนึ่งในพอลิเมอร์ชีวภาพที่มีข้อดีคือมีความทนทานการเปลี่ยนรูปสูง ดังนั้นการผสมระหว่างพอลิคาร์บอเนตและพอลิแลคติกถือเป็นทางเลือกที่ดีเนื่องจากพอลิแลคติก แอซิดมีคุณสมบัติเชิงกลที่ยอมรับได้ อย่างไรก็ตามพอลิคาร์บอเนตและพอลิแลคติก แอซิดเข้ากันได้ไม่ดีส่งผลให้สมบัติเชิงกลโดยเฉพาะความทนทานต่อแรงกระแทกและอุณหภูมิการคงรูปทางความร้อนของพอลิเมอร์ผสมระหว่างพอลิคาร์บอเนตและพอลิแลคติก แอซิดมีค่าลดลง การศึกษาครั้งนี้ได้เลือกใส่ตัวเชื่อมประสานแบบเกิดปฏิกิริยาสีชนิดคือ ไดบิวทิลทิน ออกไซด์, พอลิเอทิลีนไกลคอล แอซิด, ไลซีนไตรไอโซไซยาเนต และพอลิสไตรีนกราฟไกลลิติว เมททาโครเลต ลงไปในพอลิเมอร์ผสมเพื่อปรับปรุงความทนทานต่อแรงกระแทกและอุณหภูมิการคงรูปทางความร้อน พอลิเมอร์ทั้งสองชนิดและตัวเชื่อมประสานจะผสมกันโดยผ่านเครื่องทวินสกรูและผ่านการขึ้นรูปแบบฉีดได้ออกมาเป็นชิ้นงานเพื่อนำไปทดสอบคุณสมบัติต่างๆ ได้แก่ สันฐานวิทยา, คุณสมบัติเชิงกายภาพ, คุณสมบัติเชิงกล, และ คุณสมบัติทางความร้อนอีกด้วย สูตรผสมที่เหมาะสมคือใส่พอลิสไตรีนกราฟไกลลิติว เมททาโครเลต 0.5 ส่วนในร้อยส่วน ลงไปในพอลิเมอร์ผสมระหว่างพอลิคาร์บอเนตและพอลิแลคติก แอซิด (70 ส่วนพอลิคาร์บอเนตต่อ 30 ส่วนพอลิแลคติก แอซิด) เนื่องจากสูตรผสมนี้มีอุณหภูมิการคงรูปทางความร้อนสูงใกล้เคียงกับพอลิคาร์บอเนตและมีคุณสมบัติเชิงกล โดยเฉพาะความทนทานต่อแรงกระแทกสูง สุดท้ายสูตรผสมนี้ถูกนำไปเทียบมาตรฐานกับสูตรผสมที่นำออกวางขายตามท้องตลาดพบว่า สูตรผสมนี้มีอุณหภูมิการคงรูปทางความร้อนสูงกว่าสูตรผสมที่นำออกวางขายตามท้องตลาดและมีค่าความทนทานต่อแรงกระแทกใกล้เคียงกับสูตรผสมที่นำออกวางขายตามท้องตลาด

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**ABBREVIATIONS**

PC	Polycarbonate
PLA	Polylactic acid
DBTO	Dibuthytin oxide
EAA	Poly(ethylene-co-acrylic acid)
LTI	Lysine triisocyanate
PS-g-GMA	Poly(styrene-co-glycidyl methacrylate)
HDT	Heat distortion temperature