

**LIFE CYCLE MANAGEMENT OF BIOPLASTIC FOR A SUSTAINABLE
FUTURE: SA-MED ISLAND MODEL**

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ABSTRACT

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This research aimed to evaluate the environmental performance of selected bioplastic product produced from polylactic acid (PLA) and polybutylene succinate (PBS) based on life cycle approach. Raw materials used to produce bioplastic were cassava and sugarcane and garbage bag was selected as a model product to study. The environmental performance was then compared with the same product produced from conventional plastics (HDPE, LDPE, LLDPE). The scope of the study covered the entire life cycle of the bioplastic product, including plantation, harvesting, resin production, plastic processing, product use and disposal of the bioplastic product in Thailand. Initiated as the National Innovation Agency (NIA) pilot project, Sa-med island was selected as a model to study the use and disposal of bioplastic product by composting. The functional units were 1 kg bioplastic resin and 1 kg bioplastic product. The data were compiled and analyzed using SimaPro 7.0 with the CML baseline 2000 and the Eco-Indicator 95 methods to identify the environmental burdens with a focus on global warming potential (GWP). The cradle-to-gate results showed that GWP of PLA resin was lower than GWP of conventional plastic while the GWP of PBS was higher than GWP of conventional plastic resins, but it could potentially be reduced by applying practical improvement option. When the whole life cycle environmental impact of bioplastic was considered (cradle-to-grave), the results obtained using Sa-med island as an experimental site show that the performance of bioplastic in term of GWP is better than conventional plastics and composting is an appropriate waste management to gain highest environmental benefits from bioplastics.

บทคัดย่อ

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งานวิจัยนี้ทำการประเมินผลกระทบด้านสิ่งแวดล้อมของผลิตภัณฑ์จากพลาสติกชีวภาพที่ผลิตจากพอลิแลคติกแอซิดและพอลิบิวทิลีนซัคซิเนตตามแนวคิดตลอดวัฏจักรชีวิต วัสดุที่ใช้ในการผลิตคือมันสำปะหลังและอ้อย และเลือกถั่วเขียวเป็นผลิตภัณฑ์ที่ทำการศึกษา ซึ่งสมรรถนะทางสิ่งแวดล้อมของพลาสติกชีวภาพถูกนำไปเปรียบเทียบกับผลิตภัณฑ์ชนิดเดียวกันที่ผลิตจากพลาสติกทั่วไป (พอลิเอทิลีน HDPE LDPE และ LLDPE) ขอบเขตของการศึกษารอบคลุมตลอดวัฏจักรของการผลิตผลิตภัณฑ์พลาสติกชีวภาพ ตั้งแต่การเพาะปลูก และเก็บเกี่ยววัตถุดิบ การผลิตเม็ดพลาสติก การผลิตผลิตภัณฑ์ การใช้ จนถึงการกำจัดผลิตภัณฑ์พลาสติกชีวภาพในประเทศไทย ทั้งนี้ได้เลือกเกาะเสม็ดเป็นแหล่งศึกษาเก็บข้อมูลการใช้ และการกำจัดของผลิตภัณฑ์พลาสติกชีวภาพโดยการหมักปุ๋ย เนื่องจากเป็นโครงการนำร่องของสำนักงานนวัตกรรมแห่งชาติ (สนช.) โดยการศึกษาครั้งนี้ มีหน่วยของการศึกษา คือ 1 กิโลกรัมของเม็ดพลาสติกชีวภาพ และ 1 กิโลกรัมของผลิตภัณฑ์พลาสติกชีวภาพ ข้อมูลต่างๆ ที่เก็บรวบรวมจะถูกนำมาวิเคราะห์โดยใช้โปรแกรม SimaPro 7.0 ด้วยวิธี Eco-Indicator 95 และ CML baseline 2000 เพื่อประเมินภาระด้านสิ่งแวดล้อมด้านต่างๆ โดยเน้นที่ผลกระทบด้านภาวะโลกร้อน จากผลการศึกษาในแบบ cradle-to-gate แสดงให้เห็นว่า เม็ดพลาสติกชีวภาพชนิดพอลิแลคติกแอซิดมีผลกระทบด้านภาวะโลกร้อนต่ำกว่าเม็ดพลาสติกทั่วไป ในขณะที่เม็ดพลาสติกชีวภาพชนิดพอลิบิวทิลีนซัคซิเนตมีผลกระทบด้านภาวะโลกร้อนสูงกว่าเม็ดพลาสติกทั่วไป แต่ยังมีโอกาสที่จะทำให้ลดน้อยลงได้ด้วยกระบวนการปรับปรุงที่เหมาะสม และเมื่อพิจารณาตลอดวัฏจักรชีวิต (cradle-to-grave) ของผลิตภัณฑ์พลาสติกชีวภาพโดยใช้เกาะเสม็ดเป็นกรณีศึกษา พบว่า การใช้พลาสติกชีวภาพส่งผลดีทางด้านภาวะโลกร้อนมากกว่าพลาสติกทั่วไปชนิดพอลิเอทิลีน และการหมักปุ๋ยเป็นวิธีการจัดการขยะที่เหมาะสมที่จะได้ผลประโยชน์ต่อสิ่งแวดล้อมสูงสุดจากการใช้พลาสติกชีวภาพ

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