

**LIFE CYCLE ASSESSMENT OF POLYETHYLENE SHOPPING BAG  
PRODUCTION IN THAILAND**

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**Thesis Advisors:** Asst. Prof. Manit Nithitanakul  
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**ABSTRACT**

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Life cycle assessment (LCA) was conducted to assess the environmental impacts of the production of three commercially important plastic bag products which were conventional polyethylene, polyethylene-photo additive, and polyethylene-starch. Life cycle inventory (LCI) data were collected from six shopping bag production factories. LCA software, SimaPro 5.1 with Eco-Indicator 95 and Eco-Indicator 99 methods, was used to assess the environmental impacts. The system boundary of shopping bag production was set to include manufacturing, packaging, and transportation of raw materials and products. Functional unit was defined as one kilogram of shopping bag. The results showed that the environmental impacts of these three types of products were mainly from raw material input phase. The impact cause was mainly from use of HDPE as raw material which resulted in resources depletion, acidification potential, and heavy metals generation. The recycling phase is the second important phase that had high impact on heavy metal generation and carcinogens potential as a result of high amount of water used. Comparison among the three types of shopping bags production showed that conventional PE bag generated much higher impacts than production of both PE-photo additive and PE-starch bag. Environmental impacts of PE-photo additive and PE-starch bag production were less than conventional PE bag production about 3.11 percents and 5.33 percents, respectively.

## บทคัดย่อ

จิโรจ มีเดช : การประเมินวัฏจักรชีวิตในช่วงการผลิตถุงพลาสติกชนิดพอลิเอทิลีนในประเทศไทย (Life Cycle Assessment of Polyethylene Shopping Bag Production in Thailand)  
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งานวิจัยนี้ทำการประเมินผลกระทบต่อสิ่งแวดล้อมของกระบวนการผลิตถุงพลาสติกที่มีความสำคัญทางเศรษฐกิจของประเทศ 3 ชนิด คือ ถุงพลาสติกแบบธรรมดา ถุงพลาสติกแบบผสมสารช่วยย่อยสลายด้วยแสง และถุงพลาสติกแบบผสมแป้ง โดยใช้หลักการวิเคราะห์แบบประเมินวัฏจักรชีวิต โดยได้ทำการเก็บรวบรวมข้อมูลเพื่อทำการวิเคราะห์บัญชีรายการที่โรงงานผลิตถุงพลาสติกในประเทศไทยจำนวน 6 โรงงาน การศึกษานี้ใช้โปรแกรม SimaPro 5.1 และวิธี Eco-indicator 95 และ Eco-indicator 99 ในการประเมินผลกระทบทางสิ่งแวดล้อมของผลิตภัณฑ์ทั้งสามชนิด ขอบเขตการศึกษาของการผลิตถุงพลาสติกนี้ครอบคลุมตั้งแต่กระบวนการผลิต การบรรจุหีบห่อ รวมถึงการขนส่งวัตถุดิบและผลิตภัณฑ์ โดยข้อมูลที่นำมาวิเคราะห์จะเป็นข้อมูลเทียบต่อถุงพลาสติก 1 กิโลกรัม เมื่อทำการประเมินผลที่ได้ปรากฏว่า ผลกระทบต่อสิ่งแวดล้อมของถุงทั้งสามชนิดนี้ส่วนใหญ่มาจากช่วงการใช้วัตถุดิบ ซึ่งมีสาเหตุมาจากการใช้เม็ดพอลิเอทิลีนชนิดความหนาแน่นสูงเป็นวัตถุดิบในปริมาณมาก ซึ่งสามารถก่อให้เกิดการถดถอยของทรัพยากร ฝนกรดและโลหะหนัก ช่วงการนำกลับมาใช้ใหม่นั้นเป็นช่วงที่มีผลกระทบต่อสิ่งแวดล้อมมากเป็นอันดับสอง ซึ่งสามารถก่อให้เกิดโลหะหนักและสารก่อมะเร็งอันเป็นผลเนื่องมาจากมีการใช้น้ำในปริมาณมากในกระบวนการ ผลการเปรียบเทียบถุงทั้ง 3 ชนิด พบว่าการผลิตถุงพลาสติกแบบธรรมดานั้นมีผลกระทบต่อสิ่งแวดล้อมมากกว่าการผลิตถุงพลาสติกแบบผสมสารช่วยย่อยสลายด้วยแสง และการผลิตถุงพลาสติกแบบผสมแป้ง โดยที่ในการผลิตถุงพลาสติกแบบผสมสารช่วยย่อยสลายด้วยแสงและการผลิตถุงพลาสติกแบบผสมแป้งนั้นมีผลกระทบน้อยกว่าการผลิตถุงพลาสติกแบบธรรมดา ประมาณ 3.11 และ 5.33 เปอร์เซ็นต์ตามลำดับ

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