

**LIFE CYCLE ASSESSMENT STUDIES OF CHEMICAL AND
BIOCHEMICAL PROCESSES THROUGH THE NEW LCSOFT
SOFTWARE-TOOL**

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
in Academic Partnership with
The University of Michigan, The University of Oklahoma,
Case Western Reserve University, and Institut Français du Pétrole
2015

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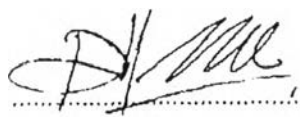
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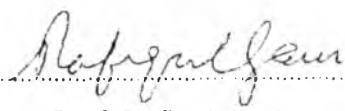
Thesis Title: Life Cycle Assessment Studies of Chemical and Biochemical Processes through the New LCSoft Software-tool
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Program: Petroleum Technology
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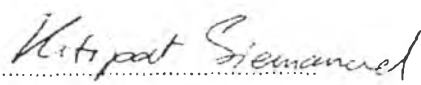
Accepted by The Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfillment of the requirements for the Degree of Master of Science.

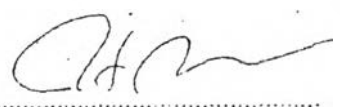

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ABSTRACT

5673018063: Petroleum Technology Program
Perapong Supawanich: Life Cycle Assessment Studies of Chemical
and Biochemical Processes through the New LCSOFT Software-tool
Thesis Advisors: Asst. Prof. Pomthong Malakul, and Prof. Rafiqul
Gani 175 pp.
Keywords: Life cycle assessment/ Life cycle inventory/ Life cycle impact
assessment/ Contribution analysis

LCSOFT software-tool has been developed to perform LCA as a stand-alone tool with ability to be integrated with other process design tools such as process simulation, economic analysis (ECON), and sustainable process design (SustainPro). The development framework consists of four main parts. The first part deals with the development of Life Cycle Inventory (LCI) calculation function. The second part consists of the extension of the LCI database and improvement of impact categories in LCIA calculation. The third part deals with analysis to investigate the contributions of processes, LCI results, and environmental impact results with respect to the production stage. The fourth part deals with validation and improvement of LCSOFT by comparing the assessment results with other available tools through the case study. LCI calculation function and four new impact categories were validated by using case study of acetic acid (98 %) production. Contribution analysis was validated by using case study of bioethanol production using cassava rhizome as a feed stock. The assessment results from both case studies were compared with commercial LCA software, SimaPro7.1. The results indicated the improvement in the performance of LCSOFT, giving accurate and reliable LCI, LCIA, and contribution analysis results with wider application range from extended inventory database.

บทคัดย่อ

พิรพงษ์ ศุภวณิช : การศึกษาการประเมินวัฏจักรชีวิตของกระบวนการทางเคมีและชีวเคมีโดยใช้ซอฟต์แวร์ประเมินวัฏจักรชีวิต แอลซีซอฟต์แวร์ (Life Cycle Assessment Studies of Chemical and Biochemical Processes through the New LCSoft Software-tool) อ. ที่ปรึกษา: ผศ. ดร. ปรมทอง มาลากุล ณ อยุธยา และ ศ.ดร. ราฟีก กานี 175 หน้า

ซอฟต์แวร์ แอลซีซอฟต์แวร์ ได้รับการพัฒนาเพื่อเป็นซอฟต์แวร์สำหรับประเมินวัฏจักรชีวิต และมีความสามารถในการประยุกต์ใช้ร่วมกับซอฟต์แวร์ออกแบบกระบวนการอื่นๆ ได้แก่ ซอฟต์แวร์จำลองกระบวนการ ซอฟต์แวร์วิเคราะห์ความคุ้มค่าทางเศรษฐกิจ ซอฟต์แวร์เพื่อประเมินความยั่งยืนของกระบวนการ กรอบการวิจัยประกอบด้วยสี่ส่วนได้แก่ ส่วนที่หนึ่ง การพัฒนาฟังก์ชันการคำนวณบัญชีรายการด้านสิ่งแวดล้อม ส่วนที่สอง การขยายฐานข้อมูลของซอฟต์แวร์ และดัชนีที่ใช้ในการประเมินผลกระทบทางสิ่งแวดล้อม ส่วนที่สาม การพัฒนาฟังก์ชันการวิเคราะห์การกระจายของผลการประเมินวัฏจักรชีวิตในกระบวนการผลิต ส่วนที่สี่ การตรวจสอบความถูกต้องและการปรับปรุงแอลซีซอฟต์แวร์ โดยเปรียบเทียบผลที่ได้จากการพัฒนา กับซอฟต์แวร์ซิมาโปร 7.1 (SimaPro7.1) ผ่านทางกรณีศึกษา การพัฒนาฟังก์ชันการคำนวณรายการด้านสิ่งแวดล้อมและดัชนีที่ใช้ในการประเมินผลกระทบทางสิ่งแวดล้อมถูกตรวจสอบความถูกต้อง โดยใช้กรณีศึกษา การผลิตกรดอะซิติก (98 %) การพัฒนาฟังก์ชันการวิเคราะห์การกระจายของผลการประเมินวัฏจักรชีวิตในกระบวนการผลิต ได้รับการตรวจสอบความถูกต้องโดยใช้กรณีศึกษา กระบวนการการผลิตเอทานอลจากเหง้ามันสำปะหลัง ผลจากการวิเคราะห์ของทั้งสองกรณีศึกษา พบว่า ผลลัพธ์ที่ได้จากสามฟังก์ชันใหม่มีความถูกต้องและเชื่อถือได้ รวมถึงซอฟต์แวร์ได้รับการพัฒนาให้มีฐานข้อมูลที่กว้างขึ้น

ACKNOWLEDGEMENTS

This work would not have been possible without the assistance of the following individuals:

First and foremost, I sincerely appreciate Asst. Prof. Pomthong Malakul, my advisor for providing invaluable knowledge, creative comments, and kind support throughout this research work.

I sincerely appreciate Prof. Rafiqul Gani for giving me the fund and the best opportunity of visiting Computer Aided Process-Product Engineering Center, Technical University of Denmark (CAPEC) and his invaluable knowledge, creative suggestions, and kind support throughout this research work.

I would like to thank Asst. Prof. Kitipat Siemanond and Assoc. Prof. Thumrongrut Mungcharoen for being my thesis committee. Their suggestions and comments are very beneficial for me and this work.

This research work was partially supported by the Ratchadapisek Sompoch Endowment Fund (2013), Chulalongkorn University (CU-56-900-FC) and Thailand Research Fund (IRG5780012).

I greatly appreciate all PPC staffs and my friends who gave me support and encouragement.

Finally, I am deeply indebted to my family for their love, understanding, encouragement, and support for me at all time.

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