

**DESIGN AND OPTIMIZATION OF A BIODIESEL REFINERY IN  
THAILAND**



Mr. Tran Bao Nguyen

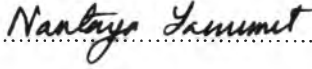
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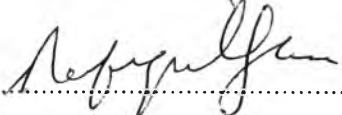
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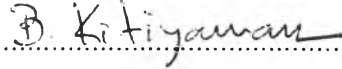
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## บทคัดย่อ

Tran Bao Nguyen: การออกแบบและปรับปรุงโรงกลั่นน้ำมันไบโอดีเซลในประเทศไทย (Design and Optimization of a Biodiesel Refinery in Thailand) อ. ที่ปรึกษา: ผศ ดร. กิติพัฒน์ สีมานนท์ และ Prof. Rafiqul Gani 91 หน้า

น้ำมันดิบในปัจจุบันมีราคาสูงขึ้นอย่างรวดเร็ว จาก 17 ดอลลาร์ต่อบาร์เรล ในปี 1995 เป็นมากกว่า 100 ดอลลาร์ต่อบาร์เรล และการใช้น้ำมันมากขึ้นก็จะส่งผลกระทบต่อสิ่งแวดล้อม เช่นภาวะโลกร้อนและมลพิษทางอากาศเนื่องจากการปล่อยก๊าซ  $\text{CO}_x$  และ  $\text{NO}_x$  ที่มีมากขึ้นไป น้ำมันไบโอดีเซล ผลิตจากน้ำมันพืชหรือสัตว์ ที่มีไตรกลีเซอไรด์ ซึ่งเป็นองค์ประกอบสำคัญของน้ำมันดีเซล การผลิตไบโอดีเซลเพื่อการค้าขายยังถูกจำกัดด้วยค่าใช้จ่ายที่สูง งานวิจัยนี้เกี่ยวกับการศึกษาและปรับปรุงโรงงานผลิตไบโอดีเซลจากน้ำมันปาล์มเพื่อลดค่าใช้จ่ายทางด้านพลังงานและลดผลกระทบต่อสิ่งแวดล้อม การปรับปรุงโรงงานต้องใช้แบบจำลองทางคอมพิวเตอร์ PRO/II และ ICAS ซึ่งทำให้พบว่าหน่วยที่ใช้พลังงานสูงในโรงงานเป็นหอกลั่นสุญญากาศ 2 ตัว การปรับปรุงซึ่งการใช้พลังงานสูงถึง 87 เปอร์เซ็นต์ของพลังงานที่ใช้ในโรงงาน การสร้างแบบจำลองและปรับปรุงหอกลั่นนี้ช่วยลดการใช้พลังงานไป 5 เปอร์เซ็นต์ หรือเป็นเงิน 400,000 ดอลลาร์ และในขณะเดียวกันก็ช่วยลดการปล่อยก๊าซคาร์บอนไดออกไซด์ ต่ำกว่า 313 ตันต่อวัน

## ABSTRACT

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Crude oil prices have been increasing rapidly in recent years from the USD 17/bbl mark in 1995 to more than USD 100/bbl currently (based on Brent crude oil), and the detrimental environmental impact, such as global warming and air pollution caused by excessive CO<sub>x</sub> and/or NO<sub>x</sub> emission have reached an alarming level. Biodiesel, which is a type of biomass derived from the triglycerides of vegetable oils and animal fats, presents a promising substitution for petroleum-based diesel fuels. At the present time, however, the commercialization of biodiesel is still very limited due to its high cost. Hence, in this project we would like to investigate and solve some of the challenges related to the production of bio-diesel from palm oil. In particular, the following two issues are investigated: the reduction of cost and the reduction of detrimental environmental impact. A specific biodiesel plant in Thailand was selected and experimentally re-designed and optimized on re-design and optimization by using PRO/II and ICAS software. The most energy consuming units in the process, i.e. two vacuum distillation columns, were identified. They consumed about 87% of the total energy supply for the plant. Simulation and optimization for these columns showed that 5% of total energy use, or 400,000 USD a year equivalent, could be reduced. As the result, environmental impact can be reduced and the total carbon offsetting is kept below 313 tons of CO<sub>2</sub> a day.

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