BIODIESEL FROM ALCOHOLYSIS OF PALM OIL UNDER SUPERCRITICAL CONDITION

ANUSAN PERMSUWAN

DOCTOR OF PHILOSOPHY
IN ENERGY ENGINEERING

Copyright by Chiang Mai University

A I I GRADUATE SCHOOL

CHIANG MAI UNIVERSITY

SEPTEMBER 2011

BIODIESEL FROM ALCOHOLYSIS OF PALM OIL UNDER SUPERCRITICAL CONDITION

ANUSAN PERMSUWAN

A THESIS SUBMITTED TO THE GRADUATE SCHOOL IN

PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN ENERGY ENGINEERING

THE GRADUATE SCHOOL
CHIANG MAI UNIVERSITY
SEPTEMBER 2011

BIODIESEL FROM ALCOHOLYSIS OF PALM OIL UNDER SUPERCRITICAL CONDITION

ANUSAN PERMSUWAN

THIS THESIS HAS BEEN APPROVED

TO BE A PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

IN ENERGY ENGINEERING

THESIS ADVISORY COMMITTEE N. Ousade CHAIRPERSON Asst. Prof. Dr. Natthawud Dussadee N. Chairperson Advisor Co-Advisor Prof. Dr. Tanongkiat Kiatsiriroat N. Chairperson Advisor Co-Advisor Co-Advisor Assoc. Prof. Dr. Nakorn Tippayawong Assoc. Prof. Dr. Nakorn Tippayawong Asst. Prof. Dr. Anucha Promwungkwa Asst. Prof. Dr. Anucha Promwungkwa MEMBER Asst. Prof. Dr. Anucha Promwungkwa MEMBER Asst. Prof. Dr. Suparin Chaiklangmuang

Asst. Prof. Dr. Sunanta Wangkarn

Prof. Dr. Tanongkiat Kiatsiriroat

9 Septerber 2011

© Copyright by Chiang Mai University

ACKNOWNLEDGEMENTS

The author would like to thank Prof. Dr. Tanongkiat Kiatsiriroat as a supervisor who patiently directed and supported this work until completion. Special thank to Asst. Prof. Dr. Dammrong Santiarworn, Asst. Prof. Dr. Churat Thararux, Mr. Danupon Jippman and Mr. Anupong Khothathum for theirs technical assistance. Additional thank go to Asst. Prof. Dr. Apiwon Polchai and Asst. Prof. Dr. Nat Vorayos for theirs encouragement even before the project had started. The author also would like to acknowledge the Commission on Higher Education, Thailand, for the financial support.

Anusan Permsuwan

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่ Copyright[©] by Chiang Mai University All rights reserved