

**PRODUCTION OF RENEWABLE DIESEL FROM PALM OIL
OVER NiMo/Al₂O₃ AND Pd/C CATALYSTS**



Teeranut Nontawong

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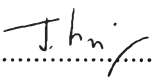
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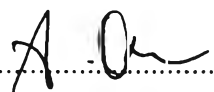
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By: Teeranut Nontawong
Program: Petrochemical Technology
Thesis Advisors: Asst. Prof. Siriporn Jongpatiwut
Prof. Somchai Osuwan
Prof. Daniel E. Resasco

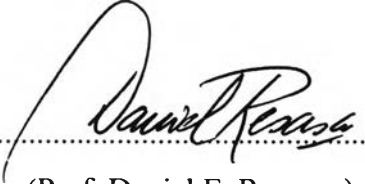
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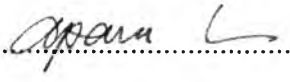

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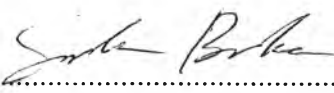
Thesis Committee:


.....
(Asst. Prof. Siriporn Jongpatiwut)


.....
(Prof. Somchai Osuwan)


.....
(Prof. Daniel E. Resasco)


.....
(Asst. Prof. Apanee Luengnaruemitchai)


.....
(Dr. Suchada Butnark)

ABSTRACT

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Teeranut Nontawong: Production of Renewable Diesel from Palm Oil over NiMo/Al₂O₃ and Pd/C Catalysts.

Thesis Advisors: Asst. Prof. Siriporn Jongpatiwut, Prof. Somchai Osuwan, and Prof. Daniel E. Resasco 50 pp.

Keywords: Bio-alkanes/ Deoxygenation/ Hydrodecarbonylation/ Hydrogenation/ Renewable diesel

The production of renewable diesel from palm oil was studied over NiMo/Al₂O₃ and Pd/C catalysts. The reactions were carried out in a packed-bed continuous flow reactor under various conditions: temperature (300–375°C), pressure (400–700 psig), H₂/feed molar ratio (15–30), and liquid hourly space velocity (0.05–5 h⁻¹). The reaction pathway was proposed in this study. Moreover, long-term stability of a selected catalyst was also tested. The results show that palm oil was converted with high selectivity to hydrocarbons in the diesel range. In the catalytic deoxygenation of palm oil over NiMo/Al₂O₃, n-hexadecane (n-C16) and n-octadecane (n-C18) were obtained as the main products. In the case of Pd/C, n-heptadecane (n-C17) and n-pentadecane (n-C15) were obtained as the main products. Moreover, the corresponding fatty acids and fatty alcohols, were observed as intermediates of the reaction. The results indicate that the deoxygenation of palm oil is preferable via hydrodeoxygenation over the NiMo/Al₂O₃ catalyst while the reaction is preferable via hydrodecarbonylation over the Pd/C catalyst. For the stability testing, NiMo/Al₂O₃ still showed high conversion and selectivity to diesel-range hydrocarbon after 10 days.

บทคัดย่อ

ธีรนุช นนทวงษ์ : การผลิตรีนิวเอเบิลดีเซลจากน้ำมันปาล์มบนตัวเร่งปฏิกิริยา NiMo/Al₂O₃ และ Pd/C (Production of Renewable Diesel from Palm Oil over NiMo/Al₂O₃ and Pd/C Catalysts) อ. ที่ปรึกษา: ผศ.ดร. ศิริพร จงผาดิวุฒิ ศ.ดร. สมชาย โอสุวรรณ และ ศ.ดร. แคนเน็ล อี รีซัสโก 50 หน้า

ในงานวิจัยนี้ทำการศึกษาการผลิตรีนิวเอเบิลดีเซลจากน้ำมันปาล์มบนตัวเร่งปฏิกิริยาที่ใช้ในเชิงการค้า NiMo/Al₂O₃ และ Pd/C ภายใต้สภาวะต่าง ๆ ดังนี้ อุณหภูมิ 300 ถึง 375 องศาเซลเซียส ความดัน 400 ถึง 700 ปอนด์ต่อตารางนิ้ว อัตราส่วนโดยโมลของไฮโดรเจนต่อสารตั้งต้น 15 ถึง 30 และอัตราการไหลของสารตั้งต้นต่อปริมาตรของตัวเร่งปฏิกิริยา 0.05 ถึง 5 ต่อชั่วโมง นอกจากนี้ยังทำการศึกษาความมีเสถียรภาพของตัวเร่งปฏิกิริยาที่สนใจ จากการศึกษาพบว่า ตัวเร่งปฏิกิริยาสามารถเปลี่ยนน้ำมันปาล์ม ไปเป็นสารไฮโดรคาร์บอนที่มีลักษณะเหมือนเชื้อเพลิงดีเซล ตัวเร่งปฏิกิริยาต่างชนิดกันมีผลให้การกระจายตัวของผลิตภัณฑ์ที่แตกต่างกัน กล่าวคือ บนตัวเร่งปฏิกิริยา NiMo/Al₂O₃ ผลิตภัณฑ์หลักที่ได้ คือ ออกตะเดเคน (n-C18) และ เฮกซะเดเคน (n-C16) ในทางกลับกัน ตัวเร่งปฏิกิริยา Pd/C ให้ผลิตภัณฑ์หลักเป็น เฮปตะเดเคน (n-C17) และ เพนตะเดเคน (n-C15) นอกจากนี้ กรดไขมันเฮกซะเดคานอนิก กรดไขมันออกตะเดคานอนิก เฮกซะเดคานอล และ ออกตะเดคานอล ยังถูกพิจารณาว่าเป็นสารมัธยันต์ในปฏิกิริยานี้ด้วย จากผลการศึกษาบ่งบอกได้ว่า ปฏิกิริยาไฮโดรดีออกซิเจนชันมักที่จะเกิดบนตัวเร่งปฏิกิริยา NiMo/Al₂O₃ ในขณะที่ปฏิกิริยาไฮโดรดีคาร์บอนิลเลชันมักที่จะเกิดบนตัวเร่งปฏิกิริยา Pd/C

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TABLE OF CONTENTS

	PAGE
Title Page	i
Abstract (in English)	iii
Abstract (in Thai)	iv
Acknowledgements	v
Table of Contents	vi
List of Tables	viii
List of Figures	x
CHAPTER	
I INTRODUCTION	1
II THEORETICAL BACKGROUND AND LITERATURE REVIEW	3
2.1 Diesel fuels	
2.1.1 Petroleum-based Diesel	3
2.1.2 Biodiesel	3
2.1.2.1 Raw Materials for Biodiesel Production	4
2.1.2.2 Biodiesel Production	4
2.2 Neste Technology (NExBTL technology)	10
III EXPERIMENTAL	19
3.1 Materials and Equipment	19
3.1.1 Chemicals	19
3.1.2 Gases	19
3.1.3 Equipment	19
3.2 Methodology	20
3.2.1 Catalytic Activity Testing	20
3.2.2 Product Analysis	22

CHAPTER	PAGE
3.2.2.1 Liquid products	22
3.2.2.2 Gas products	24
3.2.3 Catalyst Characterization	24
IV RESULTS AND DISCUSSION	25
4.1 Palm Oil Analysis Chromatogram	25
4.2 Standard Analysis Chromatogram	26
4.3 Deoxydenation of Palm Oil over NiMo/Al ₂ O ₃ Catalyst	27
4.3.1 Blank Test	27
4.3.2 Effect of Reaction Parameters	27
4.3.2.1 Effect of Liquid Hourly Space Velocity (LHSV)	28
4.3.2.2 Effect of Reaction Temperature	32
4.3.2.3 Effect of Reaction Pressure	33
4.3.2.4 Effect of H ₂ /Feed Ratio	35
4.4 Deoxydenation of Palm Oil over Pd/C Catalyst	36
4.4.1 Effect of Reaction Parameters	36
4.4.1.1 Effect of Liquid Hourly Space Velocity (LHSV)	37
4.4.1.2 Effect of Reaction Temperature	39
4.4.1.3 Effect of Reaction Pressure	40
4.4.1.4 Effect of H ₂ /Feed Ratio	41
4.5 Proposed Reaction Pathways of the Deoxydenation of Palm Oil	43
4.6 Stability Testing of Selected Catalyst	44
4.7 Temperature Programmed Oxidation (TPO)	45
V CONCLUSIONS AND RECOMMENDATION	46
REFERENCES	48
CURRICULUM VITAE	50

LIST OF TABLES

TABLE	PAGE
2.1 Physical and chemical properties of diesel (ULSD), biodiesel (FAME), and renewable diesel (green diesel)	8
2.2 Green diesel experimental summary	18
3.1 Description of flow diagram	21
3.2 The reaction conditions for studying the optimum conditions for deoxygenation of palm oil	21
3.3 The chromatographic temperature program for liquid product analysis	22
4.1 Response factor of each substance in the reference standard	27
4.2 Examined parameters for deoxygenation of palm oil	28
4.3 Conversion, n-C18/n-C17 ratio, selectivity to intermediate products, and total paraffinic hydrocarbon obtained from the deoxygenation of 25 wt% palm oil in dodecane over NiMo/Al ₂ O ₃ at 325°C, 500 psig, H ₂ /feed molar ratio: 30, and TOS: 4 h	29
4.4 Conversion, n-C18/n-C17 ratio, selectivity to intermediate products, and total paraffinic hydrocarbon obtained from deoxygenation of 25 wt% palm oil in dodecane over NiMo/Al ₂ O ₃ at 500 psig, LHSV: 3 h ⁻¹ , H ₂ /feed molar ratio: 30, and TOS: 4 h	33
4.5 Conversion, n-C18/n-C17 ratio, selectivity to intermediate products, and total paraffinic hydrocarbon obtained from deoxygenation of 25 wt% palm oil in dodecane over NiMo/Al ₂ O ₃ at 325°C, LHSV: 3 h ⁻¹ , H ₂ /feed molar ratio: 30, and TOS: 4 h	34

TABLE	PAGE
4.6 Conversion, n-C18/n-C17 ratio, selectivity to intermediate products, and total paraffinic hydrocarbon obtained from deoxygenation of 25 wt% palm oil in dodecane over NiMo/Al ₂ O ₃ at 325°C, 500 psig, LHSV: 3 h ⁻¹ , and TOS: 4 h	36
4.7 Examined parameters for deoxygenation of palm oil	37
4.8 Conversion, n-C18/n-C17 ratio, selectivity to intermediate products, and total paraffinic hydrocarbon o obtained from deoxygenation of 25 wt% palm oil in dodecane over Pd/C at 325°C, 500 psig, and H ₂ /feed molar ratio: 30, and TOS: 5 h	38
4.9 Conversion, n-C18/n-C17 ratio, selectivity to intermediate products, and total paraffinic hydrocarbon obtained from deoxygenation of 25wt% palm oil in dodecane over Pd/C at 500 psig, LHSV: 3 h ⁻¹ , and H ₂ /feed molar ratio: 30, and TOS: 4 h	40
4.10 Conversion, n-C18/n-C17 ratio, selectivity to intermediate products, and total paraffinic hydrocarbon obtained from deoxygenation of 25 wt% palm oil in dodecane over Pd/C catalyst at 325°C, H ₂ /feed molar ratio: 30, LHSV: 3 h ⁻¹ , and TOS: 4 h	41
4.11 Conversion, n-C18/n-C17 ratio, selectivity to intermediate products, and total paraffinic hydrocarbon obtained from deoxygenation of 25 wt% palm oil in dodecane over Pd/C at 325°C, 500 psig, LHSV: 3 h ⁻¹ , and TOS: 4 h	42

LIST OF FIGURES

FIGURE	PAGE
2.1 A Chemical Structure of Triglyceride	4
2.2 The production of biodiesel via transesterification of triglyceride	5
2.3 A chemical reaction of triglyceride with methanol	6
2.4 A basic schemes for biodiesel production	7
2.5 The possible liquid-phase reaction pathways for production of straight-chain hydrocarbons from fatty acids	9
2.6 Gas phase reactions of CO or CO ₂ with H ₂ or H ₂ O	9
2.7 The reaction of NExBTL renewable diesel production	10
2.8 The schemes for NExBTL process	11
2.9 The hydrodeoxygenation reaction scheme of aliphatic methyl esters (n=6) for methyl heptanoate and n=5 for methyl hexanoate)	15
2.10 The reaction pathway for conversion of triglycerides to alkanes	16
3.1 A schematic of high pressure catalytic testing unit	20
4.1 The chromatogram of 50 wt% palm oil in n-dodecane	25
4.2 The chromatogram of the standard chemicals; dodecane, pentadecane, hexadecane, heptadecane, octadecane, and eicosane	26
4.3 Conversion and product selectivity as a function of contact time, 1/LHSV (h), over NiMo/Al ₂ O ₃ (temperature: 325°C, pressure: 500 psig, H ₂ /feed molar ratio: 30, and TOS: 4 h)	29

FIGURE	PAGE
4.4 Mass spectrum of white solid obtained from GC/MS compared to that of (a) hexadecanol, (b) octadecanol, (C) hexadecanoic acid, and (d) octadecanoic acid from NIST Library	31
4.5 Conversion and product selectivity as a function of reaction temperature over NiMo/Al ₂ O ₃ (pressure: 500 psig, LHSV: 3 h ⁻¹ , H ₂ /feed molar ratio: 30, and TOS: 4 h)	32
4.6 Conversion and product selectivity as a function of reaction pressure over NiMo/Al ₂ O ₃ (temperature: 325°C, LHSV: 3 h ⁻¹ , H ₂ /feed molar ratio: 30, and TOS: 4 h)	34
4.7 Conversion and product selectivity as a function of H ₂ /feed molar ratio over NiMo/Al ₂ O ₃ (temperature: 325°C, pressure: 500 psig, LHSV: 3 h ⁻¹ , and TOS: 4 h)	35
4.8 Conversion and product selectivity as a function of contact time, 1/LHSV (h), over Pd/C (temperature: 325°C, pressure: 500 psig, H ₂ /feed molar ratio: 30, and TOS: 5 h)	38
4.9 Conversion and product selectivity as a function of reaction temperature over Pd/C (pressure: 500 psig, LHSV: 3 h ⁻¹ , H ₂ /feed molar ratio: 30, and TOS: 4 h)	39
4.10 Conversion and product selectivity as a function of reaction pressure over Pd/C (temperature: 325°C, LHSV: 3 h ⁻¹ , H ₂ /feed molar ratio: 30, and TOS: 4 h)	41
4.11 Conversion and product selectivity as a function of H ₂ /feed molar ratio over Pd/C (temperature: 325°C, pressure: 500 psig, LHSV: 3 h ⁻¹ , and TOS: 4 h)	42

FIGURE		PAGE
4.12	Long term stability testing of the NiMo/ γ -Al ₂ O ₃ catalyst on the deoxygenation of 25 wt% palm oil (temperature: 325°C, pressure: 600 psig, H ₂ /feed molar ratio: 30, and LHSV: 0.1 h ⁻¹)	44
4.13	Temperature programmed oxidation profiles of the spent NiMo/ γ -Al ₂ O ₃ and Pd/C catalysts for 13.5 h	45