

**COMPARATIVE STUDY OF HYDROGENATED BIODIESEL
AND CONVENTIONAL BIODIESEL: TECHNOLOGY
AND ECONOMICS**



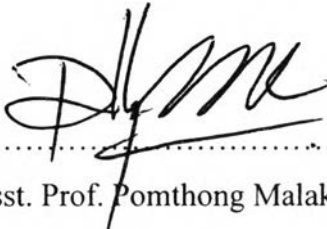
Nattawat Katinhom

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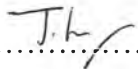
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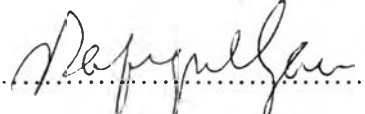
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By: Nattawat Katinhom
Program: Petrochemical Technology
Thesis Advisors: Asst. Prof. Siriporn Jongpatiwut
Asst. Prof. Kitipat Siemanond
Prof. Rafiqul Gani
Prof. Somchai Osuwan

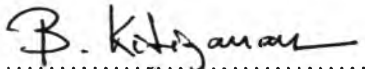
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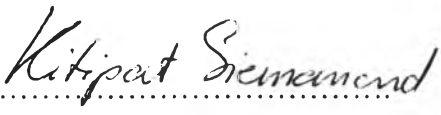

..... College Dean
(Asst. Prof. Pomthong Malakul)

Thesis Committee:



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


.....
(Prof. Rafiqul Gani)


.....
(Asst. Prof. Boonyarach Kitiyanan)


.....
(Asst. Prof. Kitipat Siemanond)


.....
(Prof. Somchai Osuwan)


.....
(Dr. Suchada Butnark)

ABSTRACT

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Nattawat Katinhom: Comparative Study of Hydrogenated Biodiesel and Conventional Biodiesel: Technology and Economics

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Hydrogenated biodiesel is referred to as diesel-like hydrocarbons that do not contain oxygen in their molecular structures. Hydrogenated biodiesel can be produced by the hydrotreating of vegetable oils or fatty acids with a standard hydrotreating catalyst and at standard conditions (NiMo/ γ -Al₂O₃, 300 °C to 450 °C, 500 psia to 2000 psia). Hydrogenated biodiesel is superior to regular biodiesel in heating value, cetane number, and oxygen content. In order to produce hydrogenated biodiesel on a commercial scale, the technology and economics of this process must be evaluated. In this study, the technology and economics of hydrogenated biodiesel are compared to that of biodiesel production, using ICAS and PRO/II[®] programs. For hydrogenated biodiesel process, an option of having steam methane reforming (SMR) unit was also evaluated. The results indicate that with palm oil as the feedstock and a capacity of 200 000 tons product/year, the capital cost and the manufacturing cost of hydrogenated biodiesel process are higher than that of the conventional biodiesel process. Reactors and distillation columns account for the major part of the capital cost for biodiesel process while compressors and hydrotreater are the major capital cost of hydrogenated biodiesel process. Adding SMR to hydrogenated biodiesel process could reduce the manufacturing cost of hydrogenated biodiesel. It was also found that in order to produce same amount of product, hydrogenated biodiesel requires higher amount of vegetable oil feedstock than biodiesel. Therefore, the production cost of biodiesel is lower than that of hydrogenated biodiesel. However, in terms of energy produced, the economics of hydrogenated biodiesel and biodiesel processes are comparable.

บทคัดย่อ

ณัฐวัฒน์ กฐินหอม: การศึกษาเปรียบเทียบเทคโนโลยีการผลิตและเศรษฐศาสตร์ระหว่างไฮโดรจีเนตไบโอดีเซลและไบโอดีเซล (Comparative Study of Hydrogenated Biodiesel and Conventional Biodiesel: Technology and Economics) อาจารย์ที่ปรึกษา: ผศ. ดร. ศิริพร จงผาดิวุฒิ ผศ. ดร. กิติพัฒน์ สีมานนท์ ศาสตราจารย์ ดร. สมชาย โอสุวรรณ และ ศาสตราจารย์ ดร. ราพีภัล กานี 119 หน้า

ไฮโดรจีเนตไบโอดีเซลคือน้ำมันดีเซลที่มีองค์ประกอบของไฮโดรคาร์บอนที่ไม่มีออกซิเจนในโครงสร้างโมเลกุลซึ่งผลิตได้ด้วยกระบวนการไฮโดรทรีตน้ำมันพืชหรือน้ำมันสัตว์โดยใช้ตัวเร่งปฏิกิริยาและสภาวะมาตรฐานของกระบวนการไฮโดรทรีต ($\text{NiMo}/\gamma\text{-Al}_2\text{O}_3$, 300 - 450 °C; 500 - 2000 psia) ไฮโดรจีเนตไบโอดีเซลมีคุณสมบัติที่ดีกว่าไบโอดีเซลทั่วไปทั้งทางด้านค่าพลังงานความร้อนเมื่อเผาไหม้ ค่าซีเทนที่สูง และปริมาณออกซิเจนที่ต่ำกว่าน้ำมันไบโอดีเซล ด้วยเหตุนี้จึงทำการศึกษาทางด้านเทคโนโลยีการผลิตและเศรษฐศาสตร์ของการผลิตไฮโดรจีเนตไบโอดีเซลในระดับอุตสาหกรรมเปรียบเทียบกับระบบการผลิตไบโอดีเซลโดยใช้โปรแกรม ICAS และ PRO/II[®] ผลการศึกษาพบว่ากระบวนการผลิตไฮโดรจีเนตไบโอดีเซลทั้งสองกระบวนการคือ กระบวนการผลิตไฮโดรจีเนตไบโอดีเซลโดยซื้อไฮโดรเจนมาใช้ในระบบ และกระบวนการผลิตไฮโดรจีเนตไบโอดีเซลที่มีหน่วยผลิตไฮโดรเจนใช้ในระบบ ใช้เงินลงทุน (Capital Investment Cost) สูงกว่ากระบวนการผลิตไบโอดีเซลทั่วไปเนื่องจากมีหน่วยคอมเพรสเซอร์และถังปฏิกรณ์เฮสเทลลอคซ์ซึ่งมีราคาสูง ส่วนค่าใช้จ่ายในการผลิต (Manufacturing Cost) กระบวนการผลิตไฮโดรจีเนตไบโอดีเซลทั้งสองกระบวนการมีค่าสูงกว่ากระบวนการผลิตไบโอดีเซลเนื่องจากต้องใช้น้ำมันปาล์มในปริมาณที่มากกว่าในการผลิตให้ได้ปริมาณน้ำมัน 200,000 ตันต่อปี แต่อย่างไรก็ตามพลังงานที่ได้จากการเผาไหม้ของน้ำมันไฮโดรจีเนตไบโอดีเซลมีค่าสูงกว่าน้ำมันไบโอดีเซลทั่วไป

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