Dissertation information

Title: Biodiesel Production From Fat of Tra Catfish and Basa Catfish in Mekong Delta Provinces via Methanolysis Reaction Using Acid and Base Catalysts

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PhD Student:: Le Thi Thanh Huong

The scientific instructor: Prof. Phan Minh Tan and Prof. Tran Thi Viet Hoa

Place of Training: Ho Chi Minh University of Technology, Vietnam National University – Ho Chi Minh City

Abstract:

Biodiesel is a environmentally benign, renewable, biodegradable fuel for use in the diesel engines. It can be produced from renewable sources such as vegetable oil or animal fat. Although this fuel has gained worldwide recognition for many years, it is not being widely commercialized mainly because it is more expensive than petroleum diesel. A cheaper feedstock, such as used oil and fat, may be used to improve the economics of biodiesel.

“Tra” and “Basa” are classified as catfish, the order Siluriformes, family Pangasidae, genus Pangasius. The scientific name of Tra and Basa are Pangasius hypophthalmus

and Pangasius bocourti, respectively. Recently, Tra and Basa production has sharply developed in Mekong Delta Provinces of Viet Nam, because of the high value of catfish fillet to export. The most important catfish farming regions that produce the greatest amount of Tra and Basa catfish are An Giang and Can Tho Provinces (Mekong Delta, Viet Nam). In the processing plants, the offal (head, bone, belly flap, fat, and fins) is fried to produce raw fish fat. Nowadays, the large quantities of the available by-products are used as animal feed. Biodiesel production from fat of Tra and Basa catfish is a new promising industry that can make use of the huge fish waste, create jobs for Mekong Delta people, and contribute to salvaging the downgrading environment.

The present work is focused on the production of biodiesel from fat of Tra and Basa catfish in Mekong Delta Provinces via methanolysis reaction using acid and base catalysts.

The dissertation has 4 chapters:

Chapter 1: Overview of biodiesel and literature

Chapter 2: Procedures

Chapter 3: Results and Discussion

Chapter 4: Conclusions and Petitions

Results

The conclusions summarized from this study are:

1. The fatty acid composition (% w/w) and physic-chemical properties of Tra and Basa fat with different cultivated methodology and location of Tra and Basa fat are defined. The results show that Tra and Basa fat are favorable raw materials for the biodiesel production. The unsaturated fatty acid

contents of Tra and Basa fat were 57.97% and 64.17%, respectively. Oleic acid ($C_{18:1}$) was the major fatty acid in both kinds of fat (39.34% and 46.62% in Tra and Basa fat, respectively). For palmitic acid (16:0), the values were 28.87% and 25.30% in Tra and Basa fat, respectively.

2. The specific conditions of GC method for quantifying methyl esters, total glycerin and free glycerin − moreover, simultaneous analysing monoglycerin, diglycerin, triglycerin, and free glycerin in the reaction composition and in biodiesel − are defined.

3. This work used homonogenous catalysts like KOH, NaOH, H_2SO_4, and PTSA for biodiesel production from Tra fat. The results assert the high activities of these catalysts. The biodiesel yields achieve 92 ÷ 93 % (NaOH và KOH) and 98 % (H_2SO_4 và PTSA). Nevertheless, the acid catalyzed methanolysis is much slower than the alkali catalyzed reaction and also needs higher methanol/fat molar ratio. This restricts the application of acid catalysts for biodiesel production in the industrial scale.

4. The solid base catalysts such as CaO and KOH/γ-Al_2O_3 are comprehensively researched for the biodiesel production from catalyst preparation, making catalyst grain, characterizing the physco-chemical properties to catalyst activities. Experimental data indicates that CaO and KOH/γ-Al_2O_3 have operated as a heterogenous catalyst and have activities similar to the homogenous base catalysts, while solid base catalysts have the advantages of being reusable in several times, easy to be separated from the completed reaction, and least polluted to the environment.

5. To rely on the reference of reports and the investigated results, possible detailed mechanisms of transesterification of Tra fat with methanol using the solid base catalysts of CaO and KOH/γ-Al_2O_3 are suggested.

6. This study investigated the effects of ultrasonic and microwave on the methanolysis reaction of Tra fat using KOH homogenous catalyst and KOH/γ-Al_2O_3 solid base catalyst. With the support from ultrasonic and microwave, the yield achieves 90 ÷ 93 % at the significantly shorter time (20 minutes) which is shorten 60 ÷ 80 % of the reaction time, in comparison with the mechanical mixing method. Ultrasonic and microwave have no influence on the chemical composition of methyl esters. Ultrasonic deactivates catalyts, but microwave only reduces the catalyst activity.

Certifying of the scientific instructor | The researcher

Prof. Phan Minh Tan Prof. Tran Thi Viet Hoa Le Thi Thanh Huong