

THESIS INFORMATION

Thesis title: **RESEARCH ON THE PRODUCTION OF BIO-BASED OIL FROM CATFISH FAT BY-PRODUCTS UNDER THE SUPPORT OF CAVITATION TECHNIQUE**

Major: **PETROCHEMICAL AND REFINING PETROLEUM TECHNOLOGY**

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1. SUMMARY

Lubricants have a great role to play in the economic development of each country, but the forecasts of depletion along with low renewable capacity of petroleum resources and negative impacts on the environment by waste lubricants is a dilemma. Vietnam is in the process of accelerating industrialization and modernization of the country, so it needs a lot of machines, engines, means of transport, freight and vehicles... Therefore, in recent years, the Vietnam's demand for lubricants has increased but now Vietnam cannot produce base oil but must import base oil from abroad. Meanwhile, Vietnam is one of the major exporters of catfish meat in the world. In the catfish processing, there will be about 30% (kl) as a by-product, mainly catfish fat. Thus, every year, Vietnam can provide a large source of catfish fat. Treating and utilizing catfish fat effectively to bring additional benefits is a issue that has not been satisfactorily answered for many years. Mung bean is a popular type of pulse popular in Vietnam and Asia. They have a relatively high starch content, of which mung bean starch has a high amylose content. The molecular structure is suitable for RS enrichment. Methods using enzymes and microwaves are very effective with different starch groups. Meanwhile, the studies on RS enrichment of mung beans mainly use autoclave or heat moisture treatments, but there are no studies using enzyme and microwave methods. In addition, the applicability of RS-rich mung bean starch in the production of gluten-free cookies to reduce the glycemic index (GI) of this product has not been investigated.

The main component of catfish fat is the ester chains of triglycerides, so it has high viscosity and similar physico-chemical properties to mineral based oils. Therefore, this research is not only scientifically meaningful but also highly feasible. On the other hand, from a by-product of the catfish processing that has the risk of causing environmental pollution, after applying appropriate production technology, it will create an environmentally friendly bio-based oil product, high economic value is considered a significant contribution in green economic development to the aquaculture sector in Viet Nam.

All processes of refining, treating and chemical conversion of catfish fat to produce bio-based oil applied cavitation techniques. The cavitation technique is considered a green chemical technique because it can significantly shorten the reaction time, and conduct the reaction at low temperature and with a low amount of chemicals consumption. Thus, when applying cavitation technique, it not only saves energy, saves chemicals, but also prevents some secondary conversions, improves process efficiency. In other words, the application of green

technology to create green, environmentally friendly products from the by-products of the agricultural production process has high scientific and practical significance.

The bio-based oil products have met the quality standards of mineral based oils and have been blended to create bio-lubricants that can be used as an alternative to mineral lubricants and environmentally friendly. Therefore, it can be concluded that the research on bio-based oil production from catfish fat not only contribute to solving environmental problems but also reducing the dependence on petroleum resources.

2. NEW CONTRIBUTIONS OF THESIS

The results of the thesis have brought new contributions as follows:

- (i) The thesis used catfish fat as feedstock in bio-lubricant production. This is a new way, opening up the possibility of producing bio-lubricants in large quantities to not only meet domestic demand but also export. Therefore, using catfish fat to produce bio-lubricants will bring high economic efficiency and create added value for the catfish farming and processing industry in Viet Nam.
- (ii) The thesis has developed a technological process to produce bio-based oils from catfish fat, including 2 main stages: processes of refining and chemical conversion. Initially, the affecting parameters of the process efficiency such as the amount of loading chemical, the temperature and the appropriate reaction time to achieve the highest process efficiency
- (iii) The thesis has applied cavitation technique in the production of bio-based oils from catfish fat. The obtained results once again show the superiority of cavitation technique such as significantly reducing reaction time, reducing chemical consumption, reducing reaction temperature but still achieving high process efficiency and especially the biological base oil products have high homogeneity in chemical composition, enhanced oxidation stability, high viscosity and high viscosity index... and have met the quality standards of mineral base oils.
- (iv) The thesis has created bio-lubricants from catfish fat by blending catfish bio-based oils with mineral based oils and additives with appropriate proportions of components. Bio-lubricant from catfish fat has basic properties such as viscosity, viscosity index, pour point, oxidation stability ... which have met the TCVN standards for mineral lubricants.

3. RECOMMENDATIONS

- Further research is needed to optimize the production of bio-based oil from catfish fat.
- Experimental study to evaluate the quality change of bio-lubricant products based on catfish fat in actual using vehicles as a basis for commercializing the research results.

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