Biodiesel Production from Non-Edible and Waste oils through Catalyzed and Superheated Uncatalyzed Approaches

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Submitted by

BISHESWAR KARMAKAR

(Registration No.: 19RCH015)

Under the supervision of

Prof. Gopinath Halder

Department of Chemical Engineering



DEPARTMENT OF CHEMICAL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

WEST BENGAL – 713209

INDIA

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ABSTRACT

The use of fossil fuels for meeting the energy demands of the 21st century is proving to be quite challenging. Hence the search and use of alternative, replenishable energy has intensified. For the transport sector, biodiesel is one of the renewable sources that can be used as a suitable alternative to petro-diesel. Biodiesel, chemically defined as 'alkyl esters of fatty acids', is commercially produced from edible oils. However this impacts the availability of edible oils or human consumption, and thus inedible and waste oils are the best source for a tropical country like India, where such sources are plenty. The presented work discusses the production of biodiesel from inedible oils such as castor, karanja, rubber seed, nagkesar, mahua as well as waste cooking oil. *Delonix regia* pods and *Mesua ferrea* linn seed shells were used as inert supports for acid and base catalyst preparation. The use of H_2SO_4 as a catalyst proved to be effective in biodiesel production from high FFA feedstock, but is cost intensive and generates large amounts of wastewater. By comparison, the use of indigenously prepared catalysts is much more cost-effective due to their reuse potential. The use of methanol in single stage biodiesel is beneficial, however usage of a dual stage process that involved both acid and base catalysts with methanol and 2-propanol respectively is much more efficient due to the complete conversion of FFAs as well as glycerides. The dual stage conversion process is also able to effectively convert compatible feedstock blends as well as use mixtures of methanol and 2-propanol for transesterification. The uncatalyzed superheated injection of alcohol or alcohol mixtures into feedstock or feedstock blends is also an effective approach for biodiesel production, especially due its versatility in handling different kinds of feedstock. The process is especially lucrative due to its simplicity and semi-continuous mode of operation which can be modified to be continuous. In addition, the process boasts a rapid reaction rate while the excess alcohol can be easily recovered through distillation and the formed glycerol can be separated by centrifugation. Thus, the process does not generate wastewater, making it environmentally safe.

Keywords: Biodiesel synthesis, Catalysts, Inedible feedstock, Process optimization, Superheated injection, Waste utilization