PRODUCTION OF BIODIESEL FROM JATROPHA OIL BY USING MICROWAVE IRRADIATION

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To my beloved father and mother
Bakheit Ahmed, Nawal Babeker
my brother and sisters..
and to all my friends
First of all, I would like to say Alhamdulillah, for giving me the strength, patience and health to go through all obstacles in order to complete this research.

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ABSTRACT

Environmental issues, the growing demand for energy, political concerns, increasing crude oil prices and the medium term depletion of petroleum created the need for the development of vegetable oils as alternative fuels. Vegetable oil based fuels (bio fuels) are promising alternative fuels for diesel engines because of their environmental and strategic advantages. Biodiesel is gaining more and more importance as an attractive fuel due to the depleting fossil fuel resources. Chemically biodiesel is monoalkyl esters of long chain fatty acids derived from renewable feed stock like vegetable oils and animal fats. The costs of feedstock and production process are two important factors which are particularly against large-scale biodiesel production. *Jatropha curcas* oil (JCO) is considered a future feedstock for biodiesel production because it is easily grown in harsh environments and is a non-edible crop that is not in demand as a food source. Microwave irradiation is one of the good methods to reduce the reaction time and get the higher yield; however, heterogeneous transesterification using a solid catalyst rather than a liquid acid or base catalyst is a more environmentally responsible way to utilize crude Jatropha oil for biodiesel production. The use of a heterogeneous catalyst also avoids neutralization and washing steps, thereby leading to a simpler and more efficient process. This project presents optimize three critical reaction parameters including catalyst concentration, microwave exit power and reaction time from the transesterification of used jatropha curcas oil (JCO) by using microwave irradiation in an attempt to reduce the production cost of biodiesel. To arrest the reaction, similar quantities of methanol to oil molar ratio (6:1) and calcium oxide as the catalyst were used. The results showed that the best yield percentage (96%) was obtained using 300W microwave exit power, 8 %(wt) CaO and 7 min. From the results obtained it was clear that free acid methyl ester (FAME) was within the standards of biodiesel and diesel fuel.
ABSTRAK

Isu alam sekitar, permintaan yang semakin meningkat untuk tenaga, kebimbangan politik, peningkatan harga minyak mentah dan kekurangan jangka sederhana petroleum mewujudkan keperluan bagi pembangunan minyak sayuran sebagai bahan api alternatif, bahan api berasaskan Minyak sayuran (bahan bakar bio) menjanjikan bahan api alternatif bagi diesel enjin kerana kelebihan alam sekitar dan strategik, Biodiesel semakin lebih dan lebih penting sebagai bahan api yang menarik kerana bahan api semakin berkurangan sumber fosil. Kimia biodiesel adalah ester monoalkyl rantaian panjang asid lemak yang diperolehi daripada stok suapan boleh diperbaharui seperti minyak sayuran dan lemak haiwan. Minyak Jatropha curcas (JCO) dianggap bahan mentah masa depan bagi pengeluaran biodiesel kerana ia mudah ditanam dalam persekitaran yang sukar tumbuh dan adalah tanaman yang tidak boleh dimakan yang tidak berada dalam permintaan sebagai sumber makanan. Penggunaan mangkin heterogen juga mengelakkan langkah peneutralan dan membasuh, sekali gus membawa kepada proses yang mudah dan lebih cekap. Projek ini membentangkan dan mengoptimukmkan tiga parameter kritikal reaksi termasuk kepekatan pemangkin, kuasa gelombang mikro keluar dan reaksi masa dari transesterification digunakan jatropha curcas minyak (JCO) dengan menggunakan penyinaran gelombang mikro dalam usaha untuk mengurangkan kos pengeluaran biodiesel. Untuk reaksi kuantiti yang sama dengan metanol kepada nisbah minyak molar (06:01) dan kalsium oksida sebagai pemangkin telah digunakan. Keputusan menunjukkan bahawa hasil peratusan terbaik (96%) telah diperolehi dengan menggunakan kuasa gelombang mikro dengan keluaran 300W, 8% (wt) CaO dan 7 min. Daripada keputusan yang diperolehi, ia adalah jelas bahawa asid metil ester (FAME) adalah bebas dalam piawaian biodiesel dan diesel.