ABSTRACT

NOVIZAR NAZIR. Process Development of Biodiesel Production from Jatropha curcas L. via In Situ Transesterification, Heterogeneous Catalysis and Detoxification. Under direction of DJUMALI MANGUNWIDJAJA, DWI SETYANINGSIH, SRI YULIANI and MOHD. AMBAR YARMO

Jatropha curcas is one source of vegetable oils to be developed as a prospective raw material of biodiesel production. Beside oil, its seed cakes, by-product of oil extraction, contains high protein which is potential for feed source, if the toxic compounds can be removed. Based on free fatty acid (FFA) content of the oil, jatropha can be distinguished into two types: jatropha that has oil with low FFA content (1.03 ± 0.10%) and one that has high content of FFA (± 6.99 %). Oil with low FFA content can be directly processed into biodiesel through one step transesterification reaction using alkaline catalyst. Oil with high FFA, however, needs pretreatment or esterification prior to transesterification. Considering this difference, a biodiesel manufacturing process from raw material was developed. Raw material of low FFA is processed by in-situ transesterification and transesterification using heterogeneous catalysts while one of high FFA was by transesterification using heterogeneous catalysts. The purpose of this process development is to produce biodiesel from jatropha seed oil and obtain edible protein-rich seed cakes for livestock feed. Toxic-removal processes for seedcake of low FFA jatropha was done directly by in-situ transesterification, while for seedcakes of high FFA was done through detoxification process using heat and chemical treatments. It was expected from this process development, high cost production could be lowered so that biodiesel can compete economically with diesel oil.

This study consists of several stages. The first stage was conducting a laboratory research aiming to obtain data for optimum conditions for transesterification process of biodiesel and for production of non-toxic seed cakes that can be used as livestock feed. The second stage was doing process design by performing a simulation using Hysys Plant Net Ver 3.2 (ASPEN Tech, Cambridge MA) based on data obtained from laboratory study. This is aimed to examine techno-economic feasibility of the developed process compared to conventional process. The third stage was conducting a Life Cycle Assessment (LCA) analysis using SIMAPRO Version 7.1 based on data obtained from the simulation process.

Keywords: Jatropha curcas L., calcium oxide, bentonite, process design, biodiesel, detoxification, techno-economic, life cycle assessment, in-situ transesterification, hsys, simapro