

**DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF  
TRANSESTERIFICATION REACTOR FOR BIODIESEL  
PRODUCTION USING WASTE VEGETABLE OIL**

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partial fulfillment of the requirements for the  
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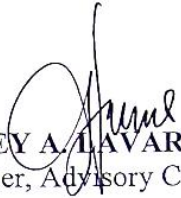
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**ACCEPTANCE SHEET**


This undergraduate thesis entitled, **DESIGN, FABRICATION, AND PERFORMANCE EVALUATION OF TRANSESTERIFICATION REACTOR FOR BIODIESEL PRODUCTION USING WASTE VEGETABLE OIL**, prepared and submitted by **HYLEEN JOY S. AGUSTIN** as partial fulfillment of the requirements for the degree of **BACHELOR OF SCIENCE IN AGRICULTURAL BIOSYSTEMS ENGINEERING (AGRICULTURAL POWER, ENERGY AND MACHINERY ENGINEERING)**, is hereby approved:

  
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## **BIOGRAPHICAL SKETCH**

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During her college life, she became a member of Student Cultural Society (SCS) for 2 years and at the same time a University Athlete of Futsal team for 4 years. She also became a member of Society of Agricultural Engineering Students – Philippine Society of Agricultural Engineers (SAGES-PSAE).

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## ABSTRACT

**AGUSTIN, HYLEEN JOY SUAREZ**, Department of Agriculture and Biosystems Engineering, College of Engineering, Central Luzon State University, Science City of Muñoz, Nueva Ecija, **June 2019. DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF TRANSESTERIFICATION REACTOR FOR BIODIESEL PRODUCTION USING WASTE VEGETABLE OIL**

Adviser: MARLON T. DELOS SANTOS, M.Sc.

Depletion of petroleum derived fuel and environmental concern has promoted to look over the biofuel as an alternative fuel sources. At present, used cooking oil is often disposed of in an environmentally hazardous manner, causing pollution and choking sewage systems. Although vegetable oil could be used directly as fuel in diesel engines, the most important limitation lies in the fact that high viscosity of vegetable oils results in poor atomization in the engines combustion chamber which eventually leads to other operational problems. Generally, biodiesel is less viscous than petroleum diesel that was good lubricant for diesel engines. This study deals with the design, fabrication and performance evaluation of transesterification reactor for biodiesel production using waste vegetable oil. The general objective of the study was to design, fabricate and evaluate the performance of transesterification reactor for biodiesel production using waste vegetable oil.

The principle of transesterification works on different parameters such as alcohol/oil ratio, catalyst concentration, reaction temperature, reaction time, and mixing speed. The treatment used were the different reaction time (90, 120 and 150 minutes) of used vegetable oil with methanol. Data were analyzed using single factor experiment at Complete Randomized Design (CRD) and comparison among means was done using Least

Significant Difference (LSD). The performance of transesterification reactor in terms of density, viscosity and yield of biodiesel were determined.

Result showed that the lowest density ( $0.86 \text{ g/cm}^3$ ) of biodiesel produced from the transesterification reactor was attained when the reaction time was at 120 minutes.

At the same reaction time, the lowest viscosity of biodiesel produced with a mean of 3.35 cst was attained when the reaction time was at 120 minutes.

While, the maximum yield of 81.82% biodiesel production was attained after 90 minutes of reaction time. Meanwhile, the lowest yield of 75.57% was attained when the reaction time was at 150 minutes.

The total investment cost of the concentrator was Php 14,700.00. Cost analysis showed that operating the transesterification reactor had a projected annual cost of 502,871.232 Php/year. The operating cost was 261.91 Php/hour and it can produce 8.18 liters of biodiesel in one hour. One-liter mixture of waste vegetable oil and methanol can convert to 818 ml of biodiesel and the cost per liter of produced biodiesel was 32.02 Php/L.

Keywords: biodiesel; transesterification; viscosity; density

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