ANALYSIS ON FUEL PROPERTIES OF CERIUM OXIDE ADDITIVE IN ALGAE BIODIESEL BY USING OPTIMIZATION TOOLS

NURUL NABILAH BINTI KHAIRUL SALLEH

(2016666096)

BACHELOR OF MECHANICAL ENGINEERING (MANUFACTURING) (HONOURS)

UNIVERSITI TEKNOLOGI MARA (UiTM)

JULY 2020

"I declared that this thesis is the result of my own work except the ideas and summaries which I have clarified their sources. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any degree."

Signed : 

Date : 9/8/2020

Nurul Nabilah Binti Khairul Salleh

UiTM No: 2016666096

"We declared that we read this thesis and in our point of view this thesis is qualified in term of scope and quality for the purpose of awarding the Bachelor of Mechanical Engineering (Manufacturing) (Hons)"

Signed : ... .

Date : ... .

10/8/2020

Supervisor

En Hazim Bin Sharudin

Faculty of Mechanical Engineering (Manufacturing)

Universiti Teknologi MARA (UiTM)

13500 Permatang Pauh

Pulau Pinang

Signed : .....

Date : 10/8/2020

Co-Supervisor

Muhammad Arif Bin Ab Hamid Pahmi (Ts)

Faculty of Mechanical Engineering (Manufacturing)

Universiti Teknologi MARA (UiTM)

13500 Permatang Pauh

Pulau Pinang

ACKNOWLEDGEMENT

I would like to express my sincere appreciation to my supervisor, Encik Hazim Bin Sharudin for convincingly guided and encouraged me upon completing this research study even when the road gets tough. Without his continual help and support, the goal of this project would not have been achieved.

I would like to express my deepest gratitude to laboratory assistants and lecturers of Faculty of Chemical Engineering in Universiti Teknologi MARA Cawangan Pulau Pinang, Faculty of Chemical Engineering and Faculty of Mechanical Engineering in Universiti Teknologi MARA Cawangan Shah Alam for the opportunity upon assisting me during completing this research. Without their full support, this project could not have reached its goal.

I wish to acknowledge the support and great love from my family especially my parents, Khairul Salleh Bin Haran and Sahimah Binti Mohd Mohye for always supporting and giving moral support to me. They kept me going on and this work would not have been possible without their financial support.

I would like to thank both of my research mates, Nur Sabira Binti Mohamed Saberi and Nor Ezzety Binti Mohammad Nizam who really help me a lot during accomplishing the research.

ABSTRACT

In recent years, biodiesel fuels have drawn a lot of attention as one of the promising energy sources that are similar to fossil fuels. The depletion of fossil fuel, particularly diesel, has led the researchers to explore on biodiesel as alternative fuel due to benefits offered such as environmentally-friendly, non-toxic characteristics, biodegradability and low net carbon cycle. Algae have attracted attention as one of the potential feedstocks as it has relatively high oil content, besides rapid biomass production. Biodiesel from algae serves lower environmental impact than crop-derived biodiesel and does not compete with food supplies. Hence, biodiesel from algae is one of the most promising alternative fuels to substitute fossil fuels in the future. Biodiesel from algae contributes to a reduction of carbon monoxide (CO), hydrocarbon (HC), and carbon dioxide (CO_2) emissions compared to diesel emissions. However, the nitrogen (NO_x) emission stemming from algae biodiesel is higher due to the presence of oxygen content. As a result, the addition of fuel additives such as nanoparticles play a major role in increasing biodiesel performance and improve the properties of the biodiesel upon reducing the nitrogen (NO_x) emission, and improving the engine performance and combustion characteristics. This research mainly presents the analysis on the properties of algae biodiesel with the addition of cerium oxide as fuel additive in terms of dynamic viscosity and calorific value. The values obtained from the fuel properties analysis were used as inputs into the Design of Expert (DOE) software to optimise the blend of algae biodiesel with cerium oxide. Analysis of the final optimum blend by the software showed that the dynamic viscosity obtained through this research was significant and the calorific value was conformed to the biodiesel standard. Thus, it proves that cerium oxide as fuel additives assists in improving fuel characteristics in algae biodiesel.