

EMISSION CHARACTERISTIC OF ALKALINE-CATALYSTS BIODIESEL

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This report is submitted as partial requirement for the completion of the Bachelor of
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VERIFICATION

I/We* have read this thesis
and from my/our* opinion thesis
Is sufficient in aspects of scope and quality for awarding
Bachelor of Mechanical Engineering (Thermal Fluids)

Signature :
Name of Supervisor :
Date :

**Line which is irrelevant*

DECLARATION

“I hereby, declare this report is resulted from my own research except as cited in the references”

Signature :

Author's Name :

Date :

DEDICATION

To my beloved parents

ACKNOWLEDGEMENT

First and foremost, I would like to take this opportunity to express my heartfelt gratitude to my final year project supervisor, Pn Mahanum Bt Mohd Zamberi, and who has graciously offered her time, attention, experience and guidance throughout the completion of project. Beside that, I also express my sincere appreciation to my senior, En. Zulkifi Ibrahim who is a master student in UTeM. He also has offered his time and experience to guide me in a correct way to successful my project.

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ABSTRACT

This study presents a testing result of emission characteristic of alkaline-catalysts biodiesel on diesel engine. The fuel had been used in this studies are a conventional diesel fuel, biodiesel fuel produce from Used Frying Oil (UFO) and Virgin Oil (VO) which catalyzed with different catalyst. There are no major modifications on the diesel engine when biodiesel used in this studies. The experimental test was carried out using gas analyzer and smoke detector. A standard checklist of gas measurement activity was developed in this study. The emission concentration level was recorded in range of 1000 rpm to 3000 rpm for each sample of sample fuel test. The result show that only small different on the concentration level of emission characteristic when different catalyst used in produce biodiesel. The different catalyst did not give the different effect on the exhaust emission characteristic when combustion alkaline-catalyst biodiesel in engine. The NaOCH_3 are determined has low-polluted factor among the biodiesel fuel sample.

ABSTRAK

Kajian ini membentangkan uji kaji tentang emisi daripada minyak biodiesel dengan pemangkin bersifat alkali. Bahan api yang digunakan dalam kajian ini adalah minyak diesel dan biodiesel yang dihasilkan daripada minyak terpakai dan minyak asli yang telah dimangkin dengan beberapa jenis pemangkin. Enjin yang digunakan tidak mengalami pengubahsuaian apabila menggunakan minyak biodiesel. Uji kaji dijalankan dengan menggunakan penganalisis gas and alat pengesan asap. Satu senarai semakan untuk proses pengukuran gas disediakan dalam kajian ini. Tahap kepekatan gas dicatatkan dengan kelajuan enjin antara 1000 rpm ke 3000 rpm. Hasil daripada kajian yang dijalankan didapati bahawa emisi yang berlainan menunjukkan tahap kepekatan yang tidak jauh berbeza antara satu sama lain apabila biodiesel menggunakan pemangkin yang berlainan. Pemangkin yang berlainan tidak akan menyebabkan tahap kepekatan emisi berlainan dalam pembakaran biodiesel dalam enjin. Kajian ini akan menentukan bahawa pemangkin NaOCH_3 merupakan biodiesel yang mempunyai emisi faktor pencemaran yang terendah.

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LIST OF SIMBOL

I_0	=	Incident light intensity
I	=	Transmitted light intensity
c	=	Concentration of light absorbing molecule
μ	=	Absorption coefficient
d	=	Thickness of absorbing molecule layer

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CHAPTER I

INTRODUCTION

1.1 Background Study

Due to the increasing interest in the use of biodiesel in recent year, there have a lot of research done on different ways to produce biodiesel such as from source of the biodiesel, catalyst and process of production. From those researches done, biodiesel can be conclude as a biodegradable and clean-burning alternative to petroleum diesel which made from domestic, renewable resources that can be manufactured from new and used vegetable oils recycled cooking oil and animal fats. Biodiesel's physical properties are similar to those of petroleum diesel, but the fuel significantly reduces greenhouse gas emissions and toxic air pollutants. Biodiesel is made from a fairly simple process. The vegetable oil or animal fat is reacted with methanol or ethanol and a catalyst, such as sodium hydroxide and potassium hydroxide to produce a methyl ester which is biodiesel.

According to Charles et al., (1995), biodiesel is gaining recognition in the United States as a renewable fuel due to increasing environmental concern which maybe used as an alternative to diesel fuel without any modification to the engine. Biodiesel fuel can be produced from ethanol and vegetable oil, both agriculturally derived products. As such, they provide several advantages; they are renewable, safer, biodegradable, contain little or no sulfur and can reduce engine exhaust smoke. Currently, the cost of this fuel is a primary factor that limits its use. One way to reduce the cost of biodiesel is by using less expensive oil which from vegetable oil

such as waste oil. The use of biodiesel in conventional diesel engines substantially reduces emissions of unburned hydrocarbons (HC), carbon monoxide (CO), sulfates, polycyclic aromatic HCs, nitrated polycyclic aromatic HCs, and particulate matter (PM). Biodiesel use also reduces greenhouse gas emissions because the carbon dioxide released in biodiesel combustion is offset by the carbon dioxide sequestered while growing the feedstock. Dorado et al. (2003) showed that nitric oxide and nitrogen dioxide are very important in polluted air. Collectively designated NO_x , regionally high NO_2 concentrations can cause severe air quality deterioration. Practically all anthropogenic NO_x enters atmosphere as a result of the combustion of fossil fuel. Most NO_x entering the atmosphere from pollution sources does so as NO generated from internal combustion engine. Like carbon monoxide, NO attaches to hemoglobin and reduce oxygen transport efficiency. However, the concentration of nitric oxide normally is much lower than that carbon monoxide so that the effect on hemoglobin is much less. In other sense, acid rain, caused by the deposition on the earth's surface of aqueous acid such as SO_2 , is mostly due to industrial operations and fossil fuel combustion. As a result of its widespread distribution and effect, acid rain is an air pollutant that may pose a threat to the global atmosphere.

1.2 Problem statement

Problem statement is the problem and difficulty of the title found in the real life. Problem statement was defined out so easy to give a solution or methods to solve the problem occur.

- 1) There are a lot of formations of exhaust gas produce from a vehicle. When gases are achieved to certain of percentage volume, it will be harm to human and environment which is known as air pollution. So there should be a method to detect the type and concentration level of exhaust gas emitted from the vehicle's engine.
- 2) There has a lot of kind of the gas analyzer in market which for detect different emission characteristic. So this study needs to decide the kind of gas analyzer to use and the method to detect the exhaust gasses.
- 3) To produce more environment friendly fuel; biodiesel fuel is the best alternative fuel to replace the diesel fuel. There will be a lot alternative source which produces biodiesel from waste oil, fat oil and plant oil.

1.3 Objective

This study is presents a technical analysis of the effect of biodiesel on exhaust emission by a diesel engine vehicles. The objective is needed to show the purpose of this study more clearly and as a goal to achieve.

The objectives of this study are as follows:

- 1) To study the common emission characteristic of Diesel Engine, and analyzer units.
- 2) To study a safely experimental procedure of Emission Measurement using existing gas analyzer.
- 3) To measure the emission characteristics of biodiesels produced from UFO and VO with alkaline-catalysts. Comparison combustion emission emitted between diesel fuel and biodiesel in diesel engine.

1.4 Scope

The scope of this study is a way to guide to represent the objective by narrow down and focus to area of objective that to be study or investigate. So, this study won't be out of the trade of development.

The scopes of this study are as follows:

- 1) To summarize the common emission characteristic from biodiesel using diesel engine and its effect to environment.
- 2) To develop the standard checklist of gas measurement activity using existing analyzer units by considering the safety.
- 3) To analyze the captured data base on several type biodiesel of UFO and VO with alkaline-catalysts, with comparison to diesel fuel and permissible standard. This study will determine the low-risk pollution factor of catalyst used during in produce UFO biodiesel.

CHAPTER II

LITERATURE REVIEW

Biodiesel is nontoxic, clean burning fuel and renewable resource which free of petroleum. Biodiesel also commonly produced by a chemical reaction termed transesterification of the vegetable oil or animal fat. In that reaction, the vegetable oil or animal oil fat is reacted in the presence of a catalyst (usually a base) with an alcohol (usually methanol) to give the corresponding alkyl ester (or for methanol, the methyl ester) of Fatty acid (FA) mixture that is found in the parent vegetable oil and animal fat. Definition of biodiesel is mono-alkyl ester of long chain FA which conforms to ASTM D6751 specifications for use in diesel engine. Biodiesel can be used in standard diesel engines and it can be used alone, or blended with petro diesel. The blends are denoted as, “BXX” representing the percentage of biodiesel contained in the blend. For example, B20 is 20% biodiesel and 80% petroleum diesel. For the environmental effect, biodiesel is better because it is made from renewable resources and has lower emission compare to petroleum diesel. Beside that, it also has a lot potentially include reduction in greenhouse gas emission, deforestation, and pollution.

2.1 Emission Characteristic

Vehicle had been emitted several of emission after combustion of fuel in engine. Most of the emission emitted was harm to human and environment. There an emission standard which require setting the limits for amount of pollutants released by vehicle. The emission which regulated by standard such as oxides of nitrogen (NO_x), oxides of sulfur (SO_x), carbon monoxide (CO), carbon dioxide (CO_2) and or volatile hydrocarbons.

2.1.1 Hydrocarbons

Hydrocarbons occur when the fuel is unburned completely or partially, Hydrocarbons also is a major contributor to smog and being toxic. This kind of pollutants can cause liver damage and even cancer. In some cases, "non-methane hydrocarbons" but "total hydrocarbons" are regulated for another case. There are technologies which meet a non-methane hydrocarbon standard and may not be suitable for use in an application that has to meet a total hydrocarbon standard. Although methane is not toxic but it is difficulty to break down in a catalytic converter, so in effect a "non-methane hydrocarbon" standard can be considered to be looser. Since methane is a greenhouse gas, interest is rising in how to eliminate emissions of it.

According to the researched of Ya-fen Lin et al., (2007), the result obtain of HC is 20 ppm for waste vegetable oil B80 at 2000 rpm and diesel fuel at 1000 rpm and 1200 rpm. Other engine speed is equal to 10 ppm.

Next researched is from Chandan.K. et. al., (2006), the fuels used was the karanji biodiesel (B100), pure premium diesel and biodiesel blends (B20, B40, B60 and B80). HC emission is found have a moderate increase for all fuel blend on lower load, but it improve on higher loads, expect B100 and B40 which decreasing for all loading condition. The highest HC obtain was 0.63g/kW-hr for B80 at 20% load.