UNIVERSITI TEKNOLOGI MARA

EFFECT OF ISOBUTANOL ADDITIVE IN PALM OIL METHYL ESTER (POME) BIODIESEL BLENDED FUEL ON ENGINE PERFORMANCE AND EMISSIONS OF DIESEL ENGINE

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Biodiesel is a suitable alternative fuel to solve global pollution and declining non-renewable resources. Despite biodiesel advantages to be used at low blending ratios up to 20%, the higher blends such as B40, B50, B60 and higher will result in the degradation of engine performance and exhaust emissions. Therefore, this research purpose is to improve engine performance and exhaust emission of diesel engine operating with B20 POME biodiesel and isobutanol as fuel additives. Four crucial fuel properties were being measured namely (1) kinematic viscosity; (2) density; (3) cetane number; and (4) calorific value. All fuel properties were tested with six fuel samples which are Diesel, B20 Palm Oil Methyl Ester (POME) biodiesel blended fuel, and another four B20 POME biodiesel blends added with 5%, 10%, 15%, and 20% in volume percentage of isobutanol additive which is denoted as B95IBU5, B90IBU10, B85IBU15, and B80IBU20 respectively. Then the assessment on engine performance characteristics were done by using YANMAR TF120M horizontal single-cylinder direct injection engine mounted on 15 kW eddy current dynamometer. While for the exhaust emission characteristics, portable Kane Automotive gas analyser model 4-1 was used. All the comparative assessments were done with Diesel and B20 fuel samples. Results indicate that the higher concentration of isobutanol additive in the fuel blends is producing fuel samples with lower density, lower kinematic viscosity, higher cetane number, and lower calorific value compared to B20 fuel sample. The best results were obtained by fuel samples with 20% volume percentages of isobutanol additives compared of B20 with reduction of density by 1.18%, decrement of kinematic viscosity by 19.5%, and increment of cetane number by 30.6%. However, the calorific value shows a setback by 3.4% for B80IBU20 compared to B20. Although the calorific value is decreasing however, it is still in the range set by the ASTM standards. The engine performance shows that the fuel samples with 5% and 10% isobutanol produce a comparable result than that B20. The brake power shows an improvement of 0.3% and 3.4% for B95IBU5 and B90IBU10 respectively compared to B20 at a high load of 2400 rpm. At a high load of 2400 rpm, the BSFC of B90IBU10 shows an improvement of 10.6% and 2% compared to the Diesel and B20 respectively. Next, the BTE of B90IBU10 shows an improvement of 3.9% and 17% compared to Diesel and B20 respectively. The exhaust emission shows the lowest CO emission for B90IBU10 at 50% load. The lowest NOx emission was obtained by B90IBU10 with an improvement of 18.7% and 16.6% compared to the Diesel and B20 respectively. Therefore, from this study, it can be concluded that a lower percentage of isobutanol additive of 5% to 10% is a promising additive to be used in the B20 POME biodiesel blended fuels.

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