



Optimisation of POME biodiesel with isobutanol additive to cater UN sustainable development goal on affordable and clean energy

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ARTICLE INFO

Keywords:

Biodiesel
Palm Oil Methyl Ester (POME)
Isobutanol additive
Engine performance
Exhaust emissions
Response Surface Methodology (RSM)

ABSTRACT

Biodiesel is a suitable alternative to solve global pollution and declining non-renewable resources. This aligns with the sustainable climate goals and policies to cater to SDG 7. Sustainable technology and solutions have to be fostered. The higher blends of biodiesel will result in engine performance and emissions degradation. Therefore, this research aims to improve the engine performance and emissions of diesel engines operating with B20 POME biodiesel and isobutanol. The Central Composite Design (CCD) model was used to construct the RSM model to determine the optimised condition of the engine testing. Engine performance and emissions of diesel engines were tested on the Yanmar TF120M at 50 % load. Six fuel samples, diesel, B20 Palm Oil Methyl Ester (POME) biodiesel blended fuel, and another four B20 POME biodiesel blends added with 5–20 % in volume percentage of isobutanol, were tested. The optimised RSM obtained a desirability of 0.7. The optimal conditions for the engine testing were at 1868 rpm and a 10 % isobutanol additive percentage. The brake power, BSFC, and BTE of the B95IBU5 and B90IBU10 show an improvement compared to the B20. The exhaust emission shows the lowest CO emission for B90IBU10 at 50 % load. The lowest NO_x emission was obtained by B95IBU5 and B90IBU10, with an improvement of 1.8 % and 2.4 %, respectively. Therefore, from this study, it can be concluded that a lower percentage of isobutanol additive of 5–10 % is a promising additive for biodiesel blended fuels.

1. Introduction

In recent years, the study of renewable energy has been boosted worldwide. This is due to problems connected to the energy crisis and environmental pollution. Biodiesel is one of the attractive renewable energies that is actively studied by all researchers worldwide. In many ways, biodiesel is a better candidate for mineral diesel substitutes. Biodiesel emits cleaner emissions, and the supplies can be renewed indefinitely because of the feedstock grown domestically. This will

reduce the dependence on petroleum products. Despite biodiesel benefits, there are some drawbacks to engine performance and exhaust emissions of compression-ignition (CI) engines fuelled with biodiesel. Most of the drawbacks related to the problems of biodiesel used in CI engines are associated with biodiesel fuel properties. Therefore, to improve these drawbacks, researchers blend biodiesel with various fuel additives to overcome the problems associated with biodiesel fuel properties. Therefore, isobutanol is one of the candidates for fuel additives to be blended with biodiesel to improve the performance and emissions of CI engines fuelled with biodiesel instead of mineral diesel.

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<https://doi.org/10.1016/j.tsep.2024.102618>

Received 27 November 2023; Received in revised form 30 April 2024; Accepted 2 May 2024

Available online 6 May 2024

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