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Comparative study of nanoparticles and alcoholic fuel additives-biodiesel-diesel blend for performance and emission improvements

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Abstract

This study aims to investigate a CI diesel engine characteristic of diesel-biodiesel blend with oxygenated alcohols and nanoparticle fuel additives. Biodiesel was synthesized from a complementary palm-sesame oil blend using an ultrasound-assisted transesterification process. B30 was mixed with fuel additives as the base fuel to form ternary blends in different proportions before engine testing. The oxygenated alcohols (DMC and DEE) and nanoparticles (CNT and TiO₂) were used to improve both the fuel characteristics and engine emission and performance parameters. B30 fuel was mixed with 5% (DEE) and 10% (DMC) by volume and 100 ppm concentration of CNT and TiO₂ nanoparticles, respectively, which are kept constant during this study. Engine performance and emissions characteristics were studied using a CI diesel engine with variable engine rpm at full load condition. The results were compared with B30 fuel and B10 (commercial diesel). The main findings indicated that the B30 + TiO₂ ternary blend shows an overall decrease in brake specific fuel consumption up to 4.1% among all tested fuels. B30 + DMC produced a higher 9.88% brake thermal efficiency, among other fuels. B30 + DMC ternary blend showed a maximum decrease in CO and HC emissions by 29.9% and 21.4%, respectively, collated to B30. B30 + CNT ternary blend showed a maximum reduction of 3.92% in NO_x emissions compared to B30.

Keywords

Author Keywords: Palm-sesame biodiesel; Oxygenated alcohols; Nanoparticles; Fuel additives; Engine performance and emissions; Alternative energy

KeyWords Plus: IRRADIATION-ASSISTED TRANSESTERIFICATION; CALOPHYLLUM-INOPHYLLUM BIODIESEL; CEIBA-PENTANDRA OIL; WASTE COOKING OIL; N-BUTANOL; ENGINE PERFORMANCE; DIETHYL-ETHER; METHYL-ESTER; OXYGENATED ADDITIVES; CARBON NANOTUBES

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