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BIODIESEL WITH FUEL ADDITIVE: AN ANALYSIS OF ENGINE PERFORMANCE, COMBUSTION AND EMISSION CHARACTERISTICS

Simon YORMESOR[1], Olusegun SAMUEL[2], Christopher ENWEREMADU[3*]

[1–3] *Department of Mechanical Engineering, University of South Africa, Science Campus, Florida 1709, South Africa*

[2] *Department of Mechanical Engineering, Federal University of Petroleum Resources, Effurun 330102, Nigeria*

[*] ***Corresponding author.*** *E-mail address: enwercc@unisa.ac.za*

Abstract – Threats to the environment from exhaust emissions and global warming continue to generate more calls by most governments to end the use of fossil fuels and switch to green fuels. This study aims to examine one of the green fuels that is seeing rapid expansion, namely the biofuel known as biodiesel. Biodiesel is non-toxic, biodegradable, made from renewable sources and can reduce diesel engine exhaust emissions. Even though one of the technical benefits of biodiesel is its ability to be oxygenated in diesel engines without much hardware modifications; however, it has been unable to reduce exhaust tail emissions from diesel engines on its own. In this research, the impact of biodiesel mixed with oxygenated additive, diethyl ether, when subjected to performance, combustion, and emission tests in unmodified diesel engine at different speeds has been studied. Waste cooking oil was transesterified using methanol as a reagent and NaOH as catalyst. The biodiesel was blended manually at room temperature with diesel fuel and diethyl ether in different proportions while keeping the volume of diethyl ether constant at 10 %. The fuel blends (B10D90, B20D80, B30D70, B10A10D80, B20A10D70, and B30A10D60) were subjected to performance, combustion, and emission tests in a single-cylinder, four-stroke diesel engine coupled to a water-cooled Eddy current dynamometer and results obtained compared with diesel fuel. The results showed that all performance characteristics (brake power (BP), brake torque (BT), brake thermal efficiency (BTE) and brake specific fuel consumption (BSFC)) improved with B10A10, which was found to closely resemble diesel. The peak cylinder pressures were higher for the blends, while the cylinder temperatures were comparable to those of diesel. The carbon monoxide (CO), carbon dioxide (CO_2), hydrocarbon (HC) and oxides of nitrogen (NO_x) emissions decreased more for all tested blends than for those of diesel at all engine speeds. Adding diethyl ether additives improved the physicochemical properties of biodiesel, making it a viable method for using biodiesel efficiently in diesel engines without modifying the engine. The study found that using green diesel fuel with a diethyl ether additive is a potential step toward improving air quality by lowering emissions from stationary, and transportation engines while maintaining optimal engine performance. As a result, using biodiesel-diesel fuels with the appropriate proportions of diethyl either additive has the potential to reduce greenhouse gas (GHG) emissions and ensure benign environment.

Keywords – Biodiesel; compression-ignition engine; diethyl ether additive; fossil fuels; green fuels