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PERFORMANCE ANALYSIS OF A COMPRESSION–IGNITION ENGINE OPERATED ON BIODIESEL FUEL PRODUCED FROM WASTE COOKING OIL METHYL ESTERS

ABSTRACT

This work investigated the potentials of waste cooking oil as an alternative feedstock for diesel engines. It involved the fuel production and its analysis phase as well as the engine performance and its analysis phase. In the first phase, biodiesel was produced from waste cooking oil. The waste cooking oil was collected from big restaurants and transesterified by heating the oil with large excess anhydrous methanol using potassium hydroxide (KOH) as a catalyst to speed up the reaction. The fuel properties such as kinematic viscosity, oxidation stability, cetane number, density and specific gravity, flash and boiling points, cloud and pour points, acid and methanol values, water content and heat of combustion (lower calorific value) were determined and compared with those of fossil diesel and the ASTM recommended values for biodiesel. The analysis enabled the chemical formula of the biodiesel to be given which helped to determine its stoichiometric combustion equation. From the analysis, the calorific value of biodiesel was 8% lower than that of fossil diesel while the viscosity, flash point and cetane number were 17%, 50%, and 10% higher respectively. In the second phase, a diesel engine was fuelled with the biodiesel and fossil diesel concurrently and the engine performance criteria such as indicated power, brake power, brake thermal efficiency, mechanical and volumetric efficiencies as well as specific fuel consumption were analyzed and compared. In addition, exhaust gas analysis was carried out to determine the pollution problems associated with the production and consumption of biodiesel. The results showed that while using biodiesel; brake power was reduced by 5% and brake specific fuel consumption increased by 10%. HC, CO and PM emissions were reduced by 11%, 7% and 6% respectively but NOx emissions increased by 15%. The work reveals that biodiesel exhibits similar performance on diesel engine when compared to fossil diesel and possesses better emission characteristics and should therefore baring the problems of availability be preferred to fossil diesel for powering diesel engines.