

ABSTRACT

The current study investigates the impact of incorporating 100 ppm calcium oxide (CaO), magnesium oxide (MgO), and zinc oxide (ZnO) nanoparticles on the performance and emission characteristics of a diesel engine running on biodiesel blends. The biodiesel was produced through the transesterification of waste cooking oil (WCO), yielding methyl ester and glycerine as a by-product. The prepared WCO methyl ester met ASTM standards for fuel properties. Experimental evaluations were conducted using a single-cylinder four-stroke diesel engine at various load conditions (20%, 40%, 60%, and 80% load). Compared to B20, the B20 blends containing 100 ppm of CaO, MgO, and ZnO nanoparticles demonstrated enhanced brake thermal efficiency and reduced specific fuel consumption. Additionally, the introduction of these nanoparticles resulted in significant reductions in hydrocarbon (HC), carbon monoxide (CO), and smoke emissions. This study highlights the potential of nanoparticle additives in biodiesel to improve engine performance and reduce environmental impact.