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ENHANCING DIESEL ENGINE PERFORMANCE AND REDUCING TAILPIPE EMISSIONS WITH BIODIESEL MIXTURE ETHANOL AND BUTANOL BLENDS AT VARYING SPEEDS

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Abstract – Using fossil fuel in diesel engines is one of the major causes of high emissions from the engine tailpipe that are hazardous to the ecosystem. The biodiesel mixture (BDM100) produced from 50 % of waste vegetable oil (WVO) and 50 % of soybean oil (SBO) has shown potential. This biodiesel blend was produced by mixing 15 % ethanol and 15 % butanol, resulting in a biodiesel mixture-ethanol blend (BMET15) and biodiesel mixture-butanol blend (BMBT15). One effective solution to such a problem is to add ethanol and butanol to a biodiesel mixture produced. This study aims to thoroughly assess and compare a single-cylinder diesel engine performance and exhaust gas emission characteristics fueled by the standard diesel (D100), BDM100, BMET15, and BMBT15. The experiments were conducted on a single-cylinder, four-stroke diesel engine at different speeds of 1000 rpm, 1500 rpm, 2000 rpm, and 2500 rpm. The results indicated that the brake power (BP) of biodiesel mixture, biodiesel mixture-ethanol blend, and biodiesel mixture-butanol blend decreased compared to standard diesel fuel. The brake-specific fuel consumption (BSFC) of biodiesel mixture, biodiesel mixture-ethanol blend, and biodiesel mixture-butanol blend increased compared to standard diesel fuel. The brake thermal efficiency (BTE) of biodiesel mixture-ethanol blend presents a higher value than standard diesel, biodiesel-mixture, and biodiesel mixture-butanol blend at maximum speed. The hydrocarbon (HC) of biodiesel mixture, biodiesel mixture-ethanol blend, and biodiesel mixture-butanol blend decreased compared to standard diesel fuel. The carbon dioxide (CO₂) of biodiesel mixture, biodiesel mixture-ethanol blend, and biodiesel mixture-butanol blend decreased compared to standard diesel fuel. The Bosch Smoke Number (BSN) of biodiesel mixture, biodiesel mixture-ethanol blend, and biodiesel mixture-butanol blend decreased compared to standard diesel fuel. Using pure biodiesel mixture, biodiesel mixture-ethanol blend and biodiesel mixture-butanol blend in a diesel engine decreases all emission characteristics compared to standard diesel fuel at a maximum speed.

Keywords – Biodiesel; biodiesel mixture; diesel engine; emissions; performance