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Experimental Investigation of the Performance and Emission Characteristics of a Diesel Engine Fuelled by Bio-Additives under Variable Loads

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Abstract : The Saudi Vision 2030 program is a government initiative aimed at increasing economic, social, and cultural diversification. Dedicated to clean energy, the Kingdom has been working on solutions such as the circular carbon economy (CCE) and diversifying its energy mix to address energy and climate challenges. With a goal of a Net Zero future by 2060, Saudi Arabia's Vision 2030 emphasizes sustainability. Vision 2030 approa ches today's energy and climate challenges responsibly and creatively as a model for a sustainable future. As per the Ambitions of the National Environment Strategy of the Saudi Ministry of Environment, Agriculture, and Water (MEWA), raising environmental compliance across all sectors and reducing pollution and adverse environmental impacts are critical focus areas.Therefore, the present paper introduces an experimental investigation of a diesel engine's performance and exhaust emissions operating with waste cooking oil (WCO) as a diesel additive. The engine type used is a one-cylinder natural-aspirated constant-speed direct-injection diesel engine. The main variables of the study were the load and the fuel type. The engine performance and emission characteristics were investigated when fueled with three blends. The first blend (D70B10W10DD10) is composed of 70% diesel, 10% butanol,10% WCO, and 10% diethyl ether. The second blend (D60B10W20DD10) is composed of 60% diesel, 10% butanol, 20% WCO, and 10% diethyl ether. The third blend (D50B10W30DD10) comprises 50% diesel, 10% butanol, 30% WCO, and 10% diethyl ether. The study results show that the engine emissions of carbon monoxide (CO) and nitrogen oxides (NOX) vary considerably with the fuel composition and applied load. Concerning engine performance, the cylinder pressure is sensitive to the load and fuel type variation.

Keywords : ICE, waste cooking oil, bio additives, butanol, combustion and emission characteristics
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