

## Experimental Study of the Efficacy and Emission Properties of a Compression Ignition Engine Running on Fuel Additives with Varying Engine Loads

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**Abstract :** The Kingdom of Saudi Arabia established Saudi Vision 2030, an initiative of the government with the goal of promoting more socioeconomic as well as cultural diversity. The kingdom, which is dedicated to sustainable development and clean energy, uses cutting-edge approaches to address energy-related issues, including the circular carbon economy (CCE) and a more varied energy mix. In order for Saudi Arabia to achieve its Vision 2030 goal of having a net zero future by 2060, sustainability is essential. By addressing the energy and climate issues of the modern world with responsibility and innovation, Vision 2030 is turning into a global role model for the transition to 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. As a result, the current study presents an experimental analysis of the performance and exhaust emissions of a diesel engine running mostly on waste cooking oil (WCO). A one-cylinder direct-injection diesel engine with constant speed and natural aspiration is the engine type utilized. Research was done on how the engine performed and emission parameters when fueled with a mixture of 10% butanol, 10% diesel, 10% WCO, and 10% diethyl ether (D70B10W10DD10). The study's findings demonstrated that engine emissions of nitrogen oxides (NOX) and carbon monoxide (CO) varied significantly depending on the load being applied. The brake thermal efficiency, cylinder pressure, and the brake power of the engine were all impacted by load change.

**Keywords :** ICE, waste cooking oil, fuel additives, butanol, combustion, emission characteristics

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