

Abstract

Comprehensive Performance Evaluation of Biodiesel Blends with Nanoparticles in Variable Compression Ratio Engines [†]

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The day-to-day rise in fuel prices, stringent emission norms, and power requirements makes the research for alternative fuels essential. The biodiesel performance in variable compression ratio (VCR) engines provides equivalent performance regarding fuel requirements. Nanoparticles play a major role in the combustion characteristics of engine analysis. Different nanoparticles with 75 ppm under varying compression ratios from 16:1 to 19:1 can be used for a combination of loads. Waste cooking oil methyl ester (WCOME) attracts widespread attention due to its availability in India and its inherent properties similar to diesel. The nanoparticles were prepared and blended using an ultrasonication process. Thus, the experiment was designed using the Taguchi design, and the results were compared with predicted results. The results showed a significant reduction in carbon monoxide (CO), hydrocarbon (HC and smoke) and were recorded with a slight increase in nitrogen oxide (NO_x) emissions. The error obtained was less than 5% for all predicted responses. This robust design is useful for predicting the engine performance with minimum cost. The experiment was first designed using the design of experiments (DOEs), and the Minitab17 version. The variables used included the compression ratio, load, and different nanoparticles under three-level and three-factor designs. The expected responses considered the brake thermal efficiency, fuel consumption, exergy efficiency, entropy generation, and CO, HC, NO_x, and smoke emissions.

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