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EFFECT OF COMPRESSION RATIOS AND MAHUA BIODIESEL BLENDS ON COATED AND UNCOATED VCR ENGINE: CHARACTERIZATION, PERFORMANCE AND EMISSION

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Abstract

It is estimated that about $6 trillion is needed to subsidize fossil fuels to meet the ensuing population demand by 2025. This encompassed explicit subsidies and tax incentives, as well as unaccounted expenses related to health and environmental consequences that were not integrated into the fossil fuel pricing structure. This staggering amount equates to an approximate daily expenditure of $11 billion. Our present research is intended to reduce the investment cost of fossil fuels at the macro level and provide non-cost benefits at the micro level. In this background, this paper aims to prove the performance, emission, and characteristics of a standard (SE) and coated (CE) Variable Compression Ratio (VCR) diesel engine with various compression ratios (CR) (17, 19, and 21) and mahua biodiesel blends (B20, B40, and B60). The experiment is conducted at a maximum power of 5.2 kW and an engine speed of 1500 rpm. Mahua biodiesel is prepared by a two-stage transesterification process and blended with diesel by volume. Thermogravimetric Analysis (TGA) and Fourier Transform Infrared spectroscopy (FTIR) are conducted to examine thermal stability and the presence of functional groups in biodiesel blends. It is found from the TGA that the reduction in mass loss with diesel and biodiesel blends of B20, B40, and B60 achieved thermal stability quickly. FTIR analysis confirmed the existence of the functional group in the biodiesel blends. From the performance test, it is observed that values of minimum brake-specific fuel consumption (0.3097 kg/kWhr), maximum brake thermal efficiency (29.92%), and reduction in exhaust gas temperature (6.36%) indicated that the minimum concentration of biodiesel blends (B20) and higher compression ratio contributed the best performance closest to diesel in the coated engine. In addition to that, the emission characteristics such as carbon monoxide (0.11%), unburnt hydrocarbon (440 ppm), and smoke (42.3%) of B60 with higher compression under full load conditions are less than those of diesel, while nitrogen oxide (554 ppm) was slightly higher than diesel in CE. The research confirmed that, based on performance, the coated engine with a higher compression ratio and a lower concentration of blend can be used as an alternate fuel for diesel by compromising emissions. Alternatively, based on emissions, a coated engine with a higher compression ratio and a higher concentration of blend can be used as an alternate fuel for diesel by compromising performance.

Key words: biodiesel, engine, emission, mahua, performance

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