Multi-objective optimization of diesel engine performances and exhaust emissions characteristics of Hermetia illucens larvae oil-diesel fuel blends using response surface methodology

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ABSTRACT

This paper investigates the utilization of response surface methodology (RSM) to optimize the engine performance and exhaust emission parameters of a compression ignition (CI) engine which operate using neat *Hermetia illucens* larvae oil (HILO) blends of 25, 50, 75, and 100% named as B25, B50, B75, and B100. The engine testing experiments were operated at different engine loads for each fuel blends and at 25 different experimental conditions. The brake power and brake mean effective pressure (BMEP) of HILO-diesel fuel blends were almost similar with diesel fuel while the brake specific fuel consumption (BSFC) was slightly increased. Furthermore, NO_x emissions decreased with HILO addition. However CO, CO_2, and UHC emissions increased. Optimization of independent variables was achieved via the RSM desirability approach with the aim of maximizing performance and minimizing emissions parameters. Therefore, the engine performance and emissions parameters for various HILO-diesel fuel blends were observed nearly similar to diesel fuel. An engine load of 92.72% and a blend of 6.43% of HILO with 93.57% diesel fuel were observed to be an optimum input point. The finding of this investigation exposed that at optimum input point, the values of the brake power, BMEP, BSFC, BTE, CO, CO_2, UHC, and NO_x were found to be 3.21 kW, 399.70 kPa, 0.071 mg/J, 27.26, 0.024, 5.30%, 0.62 ppm, and 537.93 ppm, respectively.

KEYWORDS

Response surface methodology (RSM); Engine performance; Emissions; Hermetia illucens

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