Prediction of emissions and performance of a gasoline engine running with fusel oil–gasoline blends using response surface methodology

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ABSTRACT

In this study, the engine performance and emissions of gasoline were examined by applying a response surface methodology (RSM) optimisation approach. Fusel oil–gasoline blends were used to operate an engine at various speeds and loads. The optimal fusel oil–gasoline blend mix ratio was determined to minimise fuel consumption and nitrogen oxide and hydrocarbon emissions and to maximise the brake power (BP). The results demonstrate that the engine load and speed have a significant effect on performance and emissions. In addition, the blended fuels (F10 and F20) were shown to reduce NOx emissions. Furthermore, insignificant effects on engine performance were observed for fusel oil compared with pure gasoline. The design of experiments (DoE) method, which is a statistical technique, indicated that F20 was the optimum blend ratio among the three studied fuels, based on the RSM. The optimal parameters were a load corresponding to 60% of the wide open throttle engine load and an engine speed of 4500 rpm for the F20 blend, resulting in a high desirability value of 0.852 for the test engine, with values of 67.6 kW, 235.17 g/kW.h, 0.118%vol, and 1931.4 ppm for the BP, brake-specific fuel consumption, CO emission, and NOx emission, respectively.

KEYWORDS

Design of experiments; Response surface methodology; Fusel oil; Spark-ignition engine; Performance; Emissions

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