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RESPONSE SURFACE METHODOLOGY (RSM) BASED OPTIMIZATION OF BIODIESEL-DIESEL BLENDS AND INVESTIGATION OF THEIR EFFECTS ON DIESEL ENGINE OPERATING CONDITIONS AND EMISSION CHARACTERISTICS

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Abstract

In this study, Response Surface Methodology (RSM) was applied to investigate both the effects of biodiesel percentage in fuel mixture and engine operating parameters (engine load and engine speed) on emission characteristics (unburned hydrocarbons (HC), CO and NO_x) of a diesel engine. The optimization of biodiesel percentage in fuel mixture and engine operating parameters also was performed using the desirability approach of the response surface methodology for lower emission characteristics. The experiments were designed using a statistical tool known as design of experiments based on RSM (three-factor five-level central composite rotatable design) and conducted on a four cylinder direct-injection diesel engine. The developed mathematical models were helpful to predict the response parameters and further to identify the significant interactions between the input factors on the responses. The use of biodiesel resulted in lower emissions of HC and CO and increased emissions of NO_x. Also results showed that an increase in engine speed appeared to cause a decrease in the emission of HC, CO, on the other hand NO_x and HC and CO emissions are higher at low engine loads and lower at high engine loads while NO_x, increase with engine loads. The optimum conditions for lower emission characteristics were 77.8 % for biodiesel percentage in fuel mixture, 41.25% for engine load and 2800 rpm for engine speed.

Key words: biodiesel, diesel engine, exhuast emissions, optimization, RSM

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