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Combined effects of biodiesel−ULSD blends and EGR on performance and emissions of diesel engine using Response surface methodology (RSM)

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Highlights

- Biodiesel-ULSD blends tested with EGR on diesel engine.
- Modeling and experimental study has been conducted using RSM method.
- Optimization of responses has been done with desirability approach.
- Emissions were reduced using blended fuel with tolerable limit of performance.
- Blended fuel is economical as compared to diesel during engine operation.

Abstract

Diesel engines are commonly employed in transportation and power generation. Due to the fast usage of fossil fuels such as diesel, alternative fuels for transportation and power generation are required. In present study, waste soybean cooking oil (WSCO) biodiesel is used as an alternative fuel in an agriculture-based diesel engine. The investigation has been done with blends of WSCO biodiesel-ultra-low sulfur diesel (ULSD) at different EGR rates using Response surface methodology (RSM). Binary blends were prepared by adding 20–35% v/v of WSCO biodiesel with ULSD. The results show that blend 35% v/v WSCO biodiesel-ULSD at 15% EGR (B35EGR15) has found maximum desirability. There is a significant reduction in NO_x and smoke emissions by 59.04% and 17.46% respectively for B35EGR15 as compared to ULSDEGR0 with tolerable limit of BTE. The cost analysis shows that B35EGR15 is more economical than ULSDEGR0. It is concluded that all WSCO biodiesel-ULSD blends are shown to be effective in decreasing emissions in diesel engines.