

## The Effect of Adding Fusel Oil to Diesel On the Performance and the Emissions Characteristics in a Single Cylinder CI Engine

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### ABSTRACT

Alcohol, as an alternative fuel, has attracted the attention of many companies and researchers worldwide. In fact, several studies have looked into emission and performance characteristics of alcohol used in compression-ignition (CI) engines. Fusel oil is an alcohol-based fuel collected as a by-product from the fermentation of alcohol. Hence, this experimental study compared fusel oil–diesel blended fuel F20 (20% vol fusel oil and 80% vol diesel) with pure diesel in a single cylinder four-stroke CI engine. The test was performed at two engine loads (50% and 75%) and five engine speeds (from 1200\_2400 rpm with intervals of 300 rpm). In fact, the main goal of the current study was to determine engine power, torque, indicated specific fuel consumptions, in-cylinder temperature, energy release rate, cumulative energy release, and emissions (carbon dioxide, CO<sub>2</sub>; carbon monoxide, CO; and nitrogen oxide, NO<sub>x</sub>) with F20, as well as in comparison with diesel. The results revealed that the engine power and the torque for F20 slightly dropped compared to those with pure diesel. Moreover, the indicated specific fuel consumption (ISFC) was slightly increased, especially with 75% load at high engine speeds and at around 8% at an average, while the ignition delay for F20 had been longer by 7% at all engine speeds and loads compared to those with diesel. Furthermore, a reduction in nitrogen oxide (NO<sub>x</sub>) emissions was observed at all engine loads and speeds, while the highest reduction in NO<sub>x</sub> for F20 was 28% with 1500 rpm at both loads. In addition, it was found that both CO<sub>2</sub> and CO emissions increased. Nevertheless, high water content, low cetane number, and low heating value of fusel oil had been the reasons for the negative effect displayed upon the performance of the engine.

**KEYWORDS:** Fusel oil; Emissions; Single cylinder engine; Combustion characteristics; Alternative fuels

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