

## Analysis of Blended Fuel Properties and Cycle-To-Cycle Variation In A Diesel Engine With A Diethyl Ether Additive

Obed M. Ali<sup>a</sup>, Rizalman Mamat<sup>a</sup>, H.H. Masjuki<sup>b</sup>, Abdul Adam Abdullah<sup>a</sup>

<sup>a</sup>Faculty of Mechanical Engineering, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia

<sup>b</sup>Centre for Energy Sciences, Faculty of Engineering, University of Malaya, 50603 Kuala Lumpur, Malaysia

### ABSTRACT

In this study, the effect of adding small portions of a diethyl ether additive to biodiesel–diesel blended fuel (B30) was investigated. This study includes an evaluation of the fuel properties and a combustion analysis, specifically, an analysis of the cyclic variations in diesel engines. The amount of additive used with B30 is 2%, 4%, 6% and 8% (by volume). The experimental engine test was conducted at 2500 rpm which produce maximum torque, and the in-cylinder pressure data were collected over 200 consecutive engine cycles for each test. The indicated mean effective pressure time series is analyzed using the coefficient of variation and the wavelet analysis method. The test results for the properties show a slight improvement in density and acid value with a significant decrease in the viscosity, pour point and cloud point of the blended fuel with an 8% additive ratio by 26.5%, 4 °C and 3 °C, respectively, compared with blended fuel without additive. However, the heating value is reduced by approximately 4% with increasing the additive ratio to 8%. From the wavelet power spectrum, it is observed that the intermediate and long-term periodicities appear in diesel fuel, while the short-period oscillations become intermittently visible in pure blended fuel. The coefficient of variation for B30 was the lowest and increased as the additive ratios increased, which agrees with the wavelet analysis results. Furthermore, the spectral power increased with an increase in the additive ratio, indicating that the additive has a noticeable effect on increasing the cycle-to-cycle variations.

**KEYWORDS:** Blended fuel; Cyclic variations; Diesel engine; Diethyl ether; Wavelet analysis

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