Analysis of combustion characteristics, engine performances and emissions of long-chain alcohol-diesel fuel blends

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ABSTRACT

Petroleum-based fuels have been one of the most in demand energy source for various purposes and application. However, rigorous emissions from petroleum-based fuels have forced many governments to introduce stringent regulations and concerns over energy security. Alternative fuel such as short-chain alcohol (methanol and ethanol) had been used as an oxygenated element to increase oxygen content in diesel fuel (DF). However, short-chain alcohol-diesel blends have disadvantages such as low cetane number, low heating value, increase of hydrocarbons (HC) and low miscibility with DF. Recently, researchers have shown interest on long-chain alcohols which have better physicochemical properties than short-chain alcohol. In this experiment, 5%, 10% and 20% of 2-ethyl 1-hexanol (2-EH) was added into DF to produce long-chain alcohol-diesel fuel blends. The fuel blends were prepared by using Hielscher UP400S ultrasonic emulsifier machine at 20% Hz stirring speed. The discussion will focus on combustion characteristics, engine performance and exhaust emissions of single cylinder diesel engine YANMAR TF120M at constant engine speed of 1800 rpm under various loads (0%, 25%, 50%, 75%, and 100%). The results show that HE5 has the preeminent properties among fuel blends in terms of calorific value (45.87 MJ/kg), density (806.1 kg/m^3) and viscosity (3.02 mPa·s). Performance analysis shows BTE had increased by 91.72%, while BSFC had decreased by 45.22% for 5% 2-EH (HE5).

KEYWORDS:

Diesel combustion; Long-chain alcohol; Short-chain alcohol; Engine performance; Emission