

Performance and Emission Measurement of Diesel fired Boiler using Diesel and Palm biodiesel blends

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Abstract

Biodiesel is widely accepted as comparable fuel to diesel in compression ignition engines and Diesel fired boiler. It offers many advantages including; higher cetane number, reduced emissions of particulates, CO, NO_x, and hydrocarbons, reduced toxicity, improved safety and lower lifecycle CO₂ emissions. A characteristic of bio-diesel limiting its application is its relatively poor low-temperature flow properties. Improvement of its low-temperature flow characteristic still remains one of the major challenges when using biodiesel as an alternative fuel for Diesel fire boiler. The bio-diesel fuels derived from fats or oils compounds display higher cloud points and pour points thus limiting their application. The objective of this research was to determine the relationship between Diesel fired boiler performance and emissions using diesel, volumetric blends of palm oil biodiesel and diesel as a fuel in a diesel fired vertical coil type, water tube, and non IBR boiler. Boiler efficiency with B25, B50, B75 and B100 fuels are 62.73%, 62.45%, 62.36% and 62.32% respectively, which are higher compared to 62.39% of diesel. Maximum brake thermal efficiency with B100 fuel is found 64.98%, which are lower compared to 65.30% with diesel. The higher kinematic viscosity of B100 results in larger droplet diameter and hence in lower brake thermal efficiency. Maximum EGT measure for diesel, B25, B50, B75 and B100 fuels are 300°C, 295 °C, 308°C 328°C and 340 °C respectively at 11 bar fuel pressure. Except B20, other blends shows higher EGT compared to diesel fuel. Minimum emission of CO with diesel, B25, B50, B75 and B100 fuels are 0.037 %/Vol., 0.0336

%/Vol., 0.0326 %/Vol., 0.033%/Vol. and 0.036 %/Vol. respectively at fuel pressure of 11 bar. Among all compared fuels, CO emission for B50 is lowest followed by B25, diesel and B100. At maximum fuel pressure, emission of CO with diesel, B25, B50, B75 and B100 fuels are 0.0605 %/Vol., 0.0616 %/Vol., 0.0605 %/Vol., 0.060%/Vol. and 0.05 %/Vol. respectively. CO emission with B100 fuel is 21% higher compared to diesel fuel. Highest HC emissions for diesel, B25, B50, B75 and B100 fuel are 18 ppm, 16 ppm, 14 ppm, 13ppm and 12 ppm respectively at no load. While using B100 fuel emission of HC reduces approximately half the value of HC emissions using diesel fuel.