Study of alcohol fuel of butanol and ethanol effect on the compression ignition (CI) engine performance, combustion and emission characteristic

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Diesel engine which is one of the larger contributors to total consumption for petroleum is an attractive power unit used widely in many fields. However, diesel engines are among the main contributors to air pollutions for the large amount of emissions, such as CO, CO2 and NOx lead to an adverse effect on human health. Many researches have been done to find alternative fuels that are clean and efficient. Biodiesel is preferred as an alternative source for diesel engine which produces lower emission of pollutants. This study has focused on the evaluation of diesel and alcohol-diesel fuel properties and also the performance, combustion and exhaust emission from diesel engine fuelled with diesel and alcohol. Butanol and ethanol is blend with diesel fuel at 1:9 ratio. There are three test fuel that is tested which Diesel (100% diesel), D90BU10 (10% Butanol and 90% diesel) and D90E10 (10% Ethanol and 90% diesel). The comparison between diesel and alcohol-diesel blend has been made in terms of fuel properties characterization, engine performance such as brake power (BP) and brake specific fuel consumption (BSFC) also the in cylinder maximum pressure characteristic. Thus, exhaust gas emission of CO, CO2, NOx and O2 emission also has been observed at constant load of 50% but in different operating engine speed (1100 rpm, 1400 rpm, 1700 rpm, 2000 rpm and 2300 rpm). The results show the addition of 10% of each butanol and ethanol to diesel fuel had decreased the fuel density about 0.3% to 0.5% compared to mineral diesel. In addition, viscosity and energy content are also decrease. The addition of 10% butanol had improved the fuel cetane number however the ethanol blends react differently. In term of engine performance, as the engine speed increased, BP output also increase respectively. Hence, the alcohol blends fuel generates lower BP compared to diesel, plus BSFC for all test fuel shows decreasing trend at low and medium speed, however increased gradually at higher engine speed. Thus, D90BU10 had higher BSFC compared to mineral diesel and D90E10. In general, the addition of alcohol blend in diesel fuel had increase the BSFC. In term of in cylinder pressure, as the engine speed is increased, the crank angle noted to move away from TDC for all test fuel. The maximum cylinder pressure increased at low and medium speed, but decrease in higher engine speed. The addition of 10% of butanol and ethanol in the mineral diesel decreased the maximum cylinder pressure. Meanwhile, O2 emission of D90E10 is higher compared to D90BU10 due to higher oxygen content found in ethanol. The
CO2 emission of D90BU10 recorded higher compared to mineral diesel due to the high oxygen contents in the alcohol. CO emission of alcohol blend on the other hand had lower emission at higher engine speed compared to mineral diesel. As engine speed is increased, NOx emission of mineral diesel and D90E10 had decreased gradually. However, D90BU10 had increased of NOx emission at lower to medium engine speed, than gradually decreased at higher engine speed.