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Extended Abstract

Effects of SCR System on Nox Reduction in Heavy Duty Diesel Engine Fuelled with Diesel and Alcohol Blends

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Abstract

The aim of this experimental work was to explore the effects of SCR System on NOx reduction in heavy duty diesel engine fuelled with diesel and alcohol blends. The experimental tests were performed in a 6-cylinder, turbocharged heavy duty diesel engine at full load. In the experimental tests diesel, ethanol, methanol and butanol were used as fuel. The alcohol fuel blends were prepared by mixing low sulphur diesel at volumetric rates of between 5 to 15%. The test results showed that SCR system reduce the NOx emissions 42.6% for diesel fuel. The maximum NOx reduction (43.43%) was achieved with 15% methanol–85% diesel fuel (D85M15) blend.

Keywords:

NOx emission; Alcohol; Heavy duty diesel engine

Introduction

Diesel engine is one of the crucial reason of air pollution such as nitrogen oxides (NOx), hydrocarbons (HC), carbon monoxide (CO), Carbon dioxide (CO_2), Smoke opacity, etc [1]. The extinction of petroleum fuels has led researchers to find alternative fuels [2-4]. For enhance the quality of the performance and combustion various fuel additives are recently used in the automotive sector [5]. The most investigated additives are oxygenated fuel additives in diesel engines [6]. Alcohols like as methanol, ethanol, proponal and butanol are preferred as fuels because they can be generated by fermentation of sugar from vegetable materials, like as corn, algae, sugar cane and other plant materials compraising cellulose [7,8]. Alcohol fuels have many advantages such as decrease particulate matter (PM), nitrogen oxides (NOx) and carbon monoxide (CO) exhaust emissions due to the additional oxygen in fuel [2]. There are various studies about the impacts of ethanol, methanol and butanol on diesel engine combustion and emissions

In this study, the effects of ethanol, methanol and butanol diesel fuel blends on NOx emissions of a 6-cylinder, turbocharged heavy duty diesel engine with and without SCR system was investigated. Ethanol, metanol and butanol were blended with neat diesel fuel at volumetric rates between 5 and 15%.

In the experiments, diesel, methanol, ethanol and butanol were used as fuel. The fuel blends were prepared by mixing euro diesel at volumetric rates of 5, 10 and 15%. Methanol-diesel blends specified as D95M5, D90M10 and D85M15. Ethanol-diesel blends specified as D95E5, D90E10 and D85E15. Butanol-diesel blends specified as D95B5, D90B10 and D85B15. Before start to test, engine was runned during 15 min using diesel fuel to reach operating temperature. The fuel blends were tested between 1400 rpm to 2400 rpm with interval of 200 rpm in full load conditions. The fuel propertis of diesel fuel, ethanol, methanol and butanol

Result and Discussion

The NOx emission mostly regards to nitrogen monoxide NO and nitrogen dioxide NO_2 [22]. NO is usually the most abundant NOx and compose more than 70–90% of total NOx in diesel engine exhaust [23]. Alcohol fuel blends were used for further NOx emission study in a diesel engine fitted with SCR system. The variations of nitrogen oxides (NOx) emissions of test fuels with engine speed are demonstrated in the Figures 3-5. Figure 3 shows the NOx emission values of methanol fuel blends with and without SCR system. After applying SCR system, the NOx emission is substantially reduced by 43.12%, 43.3 and 43.43% than D95M5, D90M10 and D85M15 respectively.

Conclusion

In this work, the NOx emission values of ethanol, methanol and butanol additives on a 6-cylinder, turbocharged heavy duty diesel engine with and without SCR system was investigated. The main

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findigs from this study is aligned below:

After applying SCR system for D85M15, D85E15 and D85B15 fuel blends, the NOx emission is substantially reduced by 46.45%, 45.9% and 45.5% than diesel respectively.

Addition of ethanol, methanol and butanol decrease the NOx emissions with regard to neat diesel. The reason of the reduction may be owing to the increasing oxygen content and lower cetane number of alcohol additives. Lower cetane number of ethanol, methanol and butanol blends precipitates to longer ignition delay, and leading possibly to higher combustion temperature during the premixed combustion mode.

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