

Review Article

AN OVERVIEW OF THE EFFECT OF OXYGENATED AGENTS ON THE PERFORMANCE AND EMISSION OF IC ENGINES

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ABSTRACT

IC Engines have good fuel efficiency, high power output, good thermal efficiency, but generate undesirable emissions during the combustion process. Now a day IC engines are considered as a major contributor to environmental pollutions and it pollutes the environment by emitting the mixture of gases and fine particles contains toxic chemicals. It leads many problems to the human beings as well as the environment. Investigations carried out on reducing the above said pollutants. The addition of oxygenating agents with the fuel is the best suitable one for reducing the above said problems. This paper describes a detailed overview on the effect of the addition of oxygenated agents with the fuel in IC engines. From the study of previously published articles, the addition of oxygenated agents is an effective approach for reducing CO, NO_x and HC emissions.

Keywords: oxygenating agent, IC engine, Emission, CO, NO_x and HC

INTRODUCTION

IC Engines have good fuel efficiency, high power output, good thermal efficiency, but generate undesirable emissions during the combustion process. Currently many techniques are available for improving the combustion processes of Diesel engines like fuel engine retarding, exhaust gas recirculation, high pressure injection and air intake supercharging. Now a day the petrol and diesel products are in scarcity, limited resources, not renewable and the prices of that products are increased day by day. The research on dimethyl ether as an alternative fuel gives great success. It contains oxygen element and has no C-C bonds. So it is superior to diesel even without high pressure injection and air intake supercharging. From the study of previously published articles, the addition of oxygenated agents is an effective approach for reducing CO, NO_x and HC emissions. The results show that the emission is decreased notably, when the oxygen content is increased and achieved zero smoke emission when the oxygen content is more than 30%.

Nibin et al. (2003), were conducted an investigation to enhance the performance of diesel engines by adding oxygenated agents of known quantities in a multi-cylinder diesel engine. They mixed Dimethyl carbonate with diesel in concentrations of 5%, 10% and 15% and used as a fuel. Ren et al. (2007), were conducted an investigation on combustion and emission characteristics of a direct injection diesel engine fuelled with diesel diglyme blends. The increase of the oxygen mass fraction in the blends decreases the ignition delay and the amount of heat release in the premixed combustion and also decreases the smoke concentration.

Hess et al. (2009), were conducted an investigation on six cylinder diesel engine by using a diesel reformulating agent (CETANER) has been examined with a trendy turbocharger. It results in reducing emissions in a considerable manner. The experiment done in two heavy duty diesel engines with high pressure injection system and turbocharger by J.Wang et al. (2008), gives a great hope for the possibility to reduce the particulate matter (PM) notably by new fuel design. The paper by P. Baskar (2011) et al. discussed about the effect of oxygenates on diesel engine emissions and play an important role in reducing PM, CO and HC without increasing NO_x emissions. The paper by C.Y. Lin and J.C. Huang discussed the

oxygenating additive for improving the performance and emission characteristics of marine diesel engines.

OXYGENATED AGENTS

Oxygenated agent is nothing more than fuel that has a chemical compound containing oxygen. It is used to help fuel burn more efficiently and cut down on some types of atmospheric pollution. Most of the cases, it is used to reducing the smog problem and carbon monoxide emissions. Oxygenated agent works by allowing the gasoline in vehicles to burn more completely. In addition to being complete burning, oxygenated agent also helps to cut down the amount of non-renewable fossil fuels consumed. Dimethyl carbonate (DMC), having the oxygen content is up to 53.3 wt%. So it is usually used as an oxygenated agent to blend with diesel fuel to improve combustion and reduce emissions of diesel engines. However, the low heating value and the boiling point of DMC results, when the same volumetric fuel blends are delivered, the engine power output will decrease when fueled with DMC-diesel blend, especially at condition of high loads. Ethylene glycol monoacetate (EGM) having the oxygen content of 46.1 wt%. The low heating value of EGM is higher than that of DMC and the boiling point of EGM is near to that of diesel (180-360°C). Therefore, it can enhance the properties of diesel engines that DMC in blends is partially replaced by EGM.

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Engine Performance

From the previously published articles, as the blends containing DMC and EGM decrease, the engine power outputs are reduced. The thermal efficiency increases when fuel with DMC-EGM diesel blends.

Emission

Smoke emission

It is very effective to reduce exhaust smoke by adding oxygenated agents in diesel according to the previously published articles. Figure 2 shows that the smoke emission can be reduced with the addition of DMC and EGM to diesel.

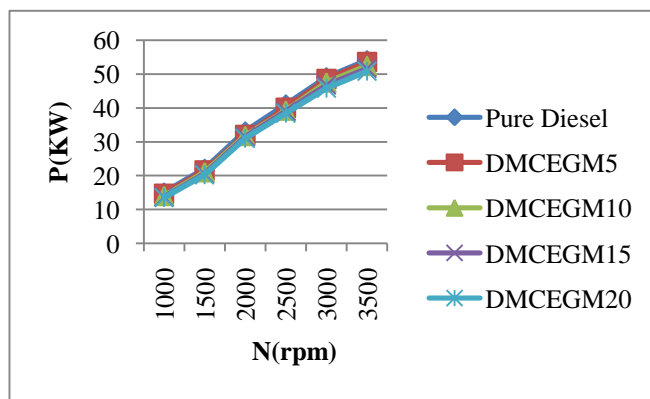


Figure 1: Engine power at full load operating conditions

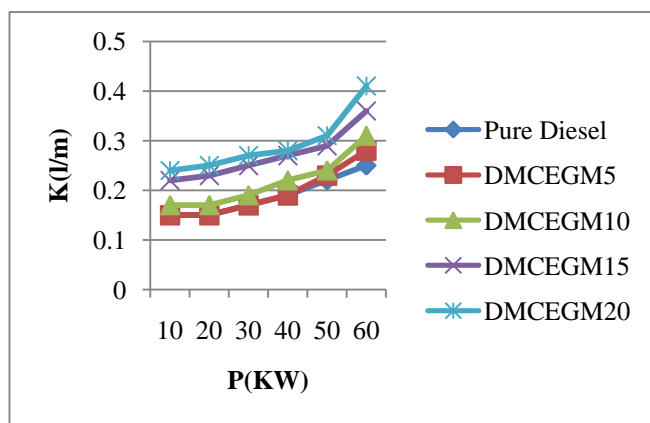


Figure 2: Smoke emissions for various fuels

NOx emissions

As per the previously published articles, the addition of DMC and EGM in diesel has little effects on the NOx emission. For high loads, NOx emissions increase little as shown in Figure 3.

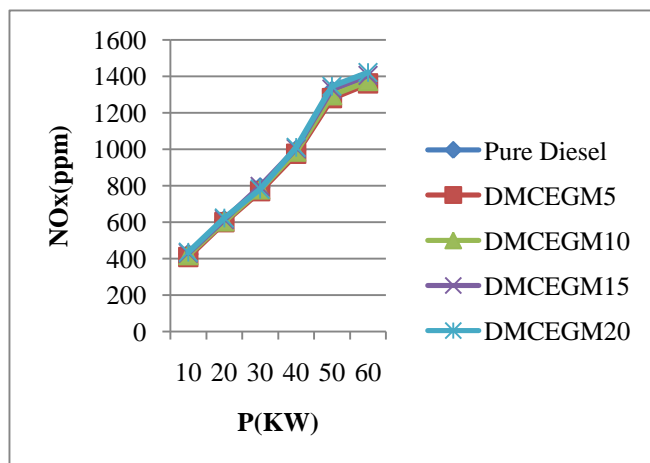


Figure 3: NOx emissions for various fuels

CO emissions

Generally, CO emissions will increase suddenly when diesel engines are run under very high load conditions. The previously published articles clear that the CO emissions can be reduced significantly by using DMC-EGM-diesel blends, especially at higher loads. Figure 4 shows the CO emission characteristics of various fuels used.

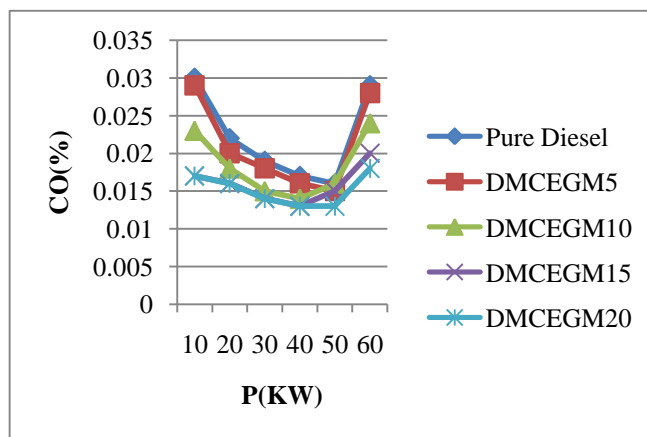


Figure 4: CO emissions for various fuels

HC emissions

The HC emissions decrease notably, when using DMC and EGM in blends increases as shown in figure 5.

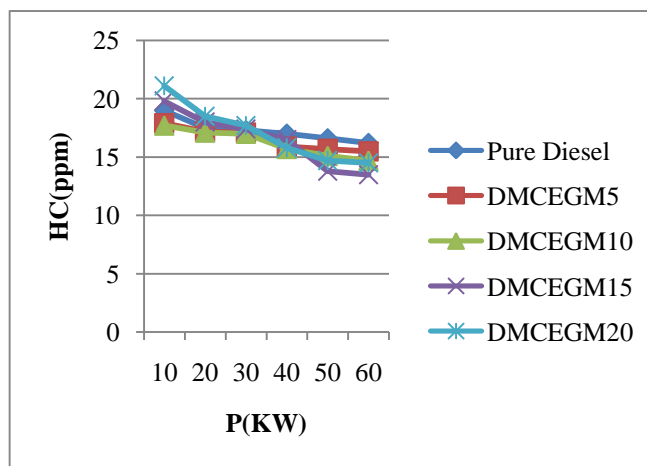


Figure 5: HC emissions for various fuels

CONCLUSION

From the available oxygenated agents, DMC and EGM have added oxygen content compared to diesel. The addition of the above said oxygenated agents to diesel notably enhances the physicochemical properties. The above results declare the prospective of the DMC-EGM-diesel blends for complete combustion in diesel engine. So, if the above said agents are added in diesel at right quantity it will enhance the engine performance and emission characteristics. If the quantity of the above said agents is high, then engine performance declines as the agents have lesser calorific value compared to diesel.

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