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Research Article

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Review of Various Additives of Petroleum Diesel and Their Effect on Environmental Parameter of Diesel Fuel

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Abstract

Increasing demand of fuel and drastic use of petroleum diesel in everyday life and its hazards cause lots many environmental issue for this beautiful planet. Intensive attention and serious efforts are required to see this problem. In this review paper some comparative study discussed to find out the certain alternative way for diesel fuel and efforts made to increase its practical performance. In this paper various oxygenated additives with different percentage are added to petroleum diesel and its effects on various performance parameters and environmental parameter are studied.

Introduction

since last decade we are witnessing extraordinary volatility in petroleum diesel prices. Reason behind this are rising crude prices and reducing of petroleum reserves. Not only that environmental hazards from exhaust emission of petroleum diesel causes for global warming. So it is now extremely essential for the development of non-petroleum fuels for engines. Due to continuously depletion of natural resources for fossil fuels at a very fast rate day by day create an uncertainty between demand and supply of petroleum diesel. Among this high level of uncertainty on both the demand and supply side of the petroleum diesel equation, every one concern with this equation are keen to gain an understanding of how to balance supply and demand resulting it can control current global economic downstream. And these are carried out only if we are able to develop new way to balance the energy crisis.

Fuel Additives

Uses of fuel additives is one of the most result oriented innovations in the field of liquid engineering as well as material science that giving natural fuel sources and additional properties which help us to increase drivability of diesel little extra. A diesel fuel additive enhance performance by providing chemical energy to the fuel by breaking down carbon deposits on combustion chamber of engine. It helps to reduce formation of soot and particulate emissions resulting very less fuel is wasted. Engine performance is also improved beside it requires less maintenance because of its smooth operation. Fuel additives are compounds that prepared to enhance the quality and efficiency of the fuels used in motor vehicles; scientists have developed a various range of additives which give these fuels an added property which improving the performance of engine.

This diesel fuel additive also promises to lubricate and clean the fuel system, increase miles per gallon by burning off excess exhaust emissions, and improve the life of injectors and pumps of engine. This diesel fuel additive is made without using any blend of oils and any solvents. Mainly it is formulated to achieve fuel mileage and power, it also helps decrease emissions by encouraging a better combustion process. Its proper blend also helps to pushes the engines to work at maximum level efficiency. Measure objective behind preparation of this additives development is to increase combustion rates, as anti-oxidants, to effect on burning rates, to make possible for fuels to work under extreme temperatures, reduce harmful emissions during combustion. Since last few decades' various hybrid compounds and blends have been tested to create better fuels.

Classification Of Fuel Additives

The types of additives include antioxidants (stabilizers), antiknock agents, fuel dyes, oxygenates, ethers, metal deactivators, corrosion inhibitors and some that can't be categorized.

Oxygenates

These contain oxygen in their chemical structure. They have tendency to minimize the carbon monoxide emissions in smoke coming out from combustion chamber during burning of fuel. Oxygenates can be based on either alcohol or di isopropyl ether (DIPE) , Ethyl tertiary butyl Ether (ETBE), Ethanol, Methanol, N-Butanol , Tertiary butyl alcohol (TBA) , Tertiary-Amyl Methyl Ether (TAME) ,

Antioxidants are the molecule that inhibits the oxidation of other molecule. Oxidation reaction produce free radicals leading to chain reactions and antioxidants terminate this chain reaction by disrupting radical intermediates and stopping further oxidation. Some of antioxidants are used as a stabilizer in fuel which prevent

oxidation. Examples of some antioxidants used are: Di-tert-butyl phenol- Phenylene diamine • Ethylene diamine • Butylated hydroxyl toluene • 2, 4-Dimethyl-6-tert-butylphenol •

Metal Deactivators

Metal deactivators also known as metal deactivating agents (MDA) these are fuel additives and oil additives used to stabilize fluids by deactivating metal ions, some metal ion produced by the action of naturally occurring acids in the fuel.

An example of a metal deactivator that is often use is N, N'disalicylidene-1, 2- propane di amine.

Corrosion Inhibitors

A corrosion inhibitor is a substance that added in a very small concentration to reduce the corrosion rate of a metal. Inhibitors often play an important role in the oil extraction. Corrosion inhibitors are additives that prevent chemical attack on a metal surface. This group of additives repels water and neutralizers the acidic reaction. Some of the corrosion inhibitors are phenylene diamine, hexamine, and dimethyl ethanolamine, and their derivatives sometimes sulphite and ascorbic acid are also used as a corrosion inhibitor.

Other Additives

There are several other fuel additives that don't fall into the same categories as the above. Some of these are

- Acetone – this is a vaporization additive. It is used, together with methanol, to improve vaporization when the engine starts up.
- Nitromethane – is used to up the engine power – commonly referred to as 'nitro'.
- Ferrous picrate is used to improve combustion and increase mileage.
- Ferro- this is a catalyst additive used to increase fuel efficiency, clean the engine, extend the life of the engine, Lower emissions.

Research Studies

It was found that the use of biodiesel and Additive-Diesel blend is rapidly increasing around the world. Reason behind research thrust of this is that the petroleum reserves are depleting rapidly and blended fuel mixture give the better performance than traditional fuel which is investigated by researchers. An experimental study by R. Rama Udaya Marthanda et.al. Had been carried on 4-stroke C. I Engine with different blends of Ethyl Alcohol & disel with n-butanol as an additive. An experimental study by R. Rama Udaya Marthanda et.al. Had been carried on 4-stroke C.I Engine with different blends of Ethyl Alcohol & disel with n-butanol as an additive. A test rig for an experimental study by A Y F Bokhary, Majed Alhazmy, Nafis Ahmad and Abdulrahman Albahkali was developed to run a single cylinder, 4-stroke, 470 cc, and CT 300 variable compression ratio spark ignition engine. The engine was coupled to an electrical dynamometer, which is equipped with an instrument cabinet (column mounted) fitted with a torque gauge, electric tachometer and switches for the load remote control. C.

Experimental results was find out by Nasarullah. M and Raja Gopal. K on Kirloskar, AV-1 Four- stroke, single cylinder, Compression Ignition engine, with variable compression ratio fuelled with diesel, It had 80mm×110mm bore × stroke and compression ratio 16.5:1, variable from 13.5 to 20 with a rated power of 3.7kW at 15000 rpm torque output of 340 N m at 1500 rpm. Methyl ester of jatropha oil (MEJO) and MEJO with ignition improver and Ethanol is used as fuel. D. An experimental investigation was carried out by V.Pirozfar, A.Z.Moghadam, S.sepehri, M.R. Omidkhah, A.Ameri. The performance of the new fuel formulations were studied on a MB-OM 457 LA diesel engine in Idle and cutoff speed position and Commercial diesel fuel and analysisgrade anhydrous ethanol (99.7% purity) were used in this test. In this experiment investigation the blend of 5% ethanol and 95%diesel is called E5. E. An experimental study was carried out by Mojtaba Saei Moghaddam, Abdolsamad Zarringhalam Moghaddam. The experimental study was carried out on ECE R-96 8modes cycle the engine used in this study was a commercial DI, water cooled four cylinders, in-line, turbocharged, aspirated diesel engine (MT4.244). It had 3.99-L displacement, 100-mm × 127-mm bore × stroke and 17.5 compression ratio with a peak power output of 61.5 kW at 2200 rpm and a peak torque output of 340 N m at 1500 rpm. The Nitromethane (NM) and Nitroethane (NE) were blended with diesel fuel 10% in volume to produce three different fuels as sole diesel, NM + diesel, and NE + diesel is used as fuel for investigation.

Results and Discussion

Engine Efficiency

Engine efficiency study help us to know about effect of blended fuel on engine. To understand this the brake specific fuel consumption (BSFC) and thermal efficiency of the engine were measured at different load and with different engine speed. According to result of R. Rama Udaya Marthanda et.al, when the engine runs at 1250 rpm on different engine loads, for the blends of B5D65E30, the BSFC is increased by 4% for the blends of B5D85E10 BSFC is decreased by 1.2% for maximum engine load and the blends of B5D75E20 BSFC is average by 2.5% up and down. V.Pirozfar, A.Z.Moghadam, S.sepehri, M.R. Omidkhah, A. Ameri shows by his experiment that the nitro Ethan restores the cetane number of the diesel fuel better than 2Methoxy ethyl ether (MXEE) and nitro Methane. Blending ethanol to the Tehran1 diesel fuel shows a profound effect on soot reduction (25% soot reduction with 10% ethanol). The soot formation can be reduced by more than 50%, 30% and 27% with the diesel formulations. Experimenal investigation by Chandan Kumar, Manish Bafna, Ashish Nayyar, Ved Parkash Nitin Goyal shows that When brake power is increases, the brake thermal efficiency of the nitromethane-diesel blend at compression ratio 17.5:1 is decreases as compare to diesel at compression ratio 17.5:1 and compression ratio 16.5. Brake thermal efficiency of diesel at compression ratio 17.5:1 is decreases at higher load.

Engine Emissions

The exhaust emissions like carbon monoxide (CO), carbon dioxide (CO2), unburned hydrocarbons (HC), oxides of nitrogen (NOx), and the Bosch smoke number (SN). Were compared for different Additives-Diesel fuel mixture at different operating condition.

COMPARISON OF CO EMISSIONS

Result of Mojtaba Saei Moghaddam, Abdolsamad Zarringhalam Moghaddam sows that The CO concentration in the exhaust gas has been reduced with Nitro ethane as the additive and increased with Nitro Methane as additive. According to investigation of Nasarullah. M and Raja Gopal. K. The CO emissions reduced by increasing ethanol percentage in diesel-ethanol blends. The emissions of CO in diesel ethanol blends were comparatively lower than the diesel fuel at high loads. The CO emissions were decreased by 19.10%, 21.34%, 22.47%, 23.59%, 33.7% and 29.21% respectively with MEJO, MEJO5ETNM2, MEJO10ETNM2, MEJO15ETNM2,

MEJO20ETNM2 and MEJO25ETNM2

COMPARISON OF CO2 EMISSIONS

According to experimental investigation of Nasarullah. M and Raja Gopal. K. The carbon dioxide emissions increased with brake power for all fuel modes. The CO2 emissions of biodiesel-ignition improver-ethanol were higher than the, biodiesel, biodiesel-ignition improver and diesel fuel.

COMPARISON Of Unburned HC EMISSIONS

According to experimental investigation of Nasarullah. M and Raja Gopal. K. the HC emissions of biodiesel-ignition improver-ethanol blends were 44ppm, 48ppm, 47ppm, 46ppm and 45ppm respectively with MEJO20ETNM2, MEJO5ETNM2, MEJO10ETNM2, MEJO15ETNM2 and MEJO25ETNM2 at full load of the engine

COMPARISON Of NOX EMISSIONS

Result of Mojtaba Saei Moghaddam, Abdolsamad Zarringhalam Moghaddam shows that in diesel engines smoke generation has an inverse relation-ship with NOx emission. The results study show that in the presence of additives, the soot formation is reduced, while the NOx is increased confirming the above relation NOx emission shows a 5.1% increase for Nitro Methane and 6.3% increase for Nitro ethane compared with Diesel. According to experimental investigation of Nasarullah. M and Raja Gopal. K the NOx emissions are increased as the engine load increases due to increase in combustion temperature.

COMPARISON OF BOSCH SMOKE NUMBERS (SN)

Result of experimental Mojtaba Saei Moghaddam, Abdolsamad Zarringhalam Moghaddam in case of both the additive Nitro methane and Nitro ethane smoke is reduced and fluctuation with engine operation mode is less pronounced. [1-22].

Conclusions

The objective of this review paper is to compare the performance of additive and emissions parameter of blended diesel that studied by various authors in which they are trying to carry out an experimental investigation on diesel by adding certain additives such as Ethyl nitrate, Butyl nitrate, Di isopropyl ether and Di methyl ether Nitromethane and Nitro ethane.

In this regard the authors carried out a research on previous works and make certain conclusions on the concerned work.

1. Alcohols can be used successfully in combination with diesel by adding certain additives.
2. Combustion processes inside the cylinder is better with ethanol blend.
3. Blending ethanol to the Tehran1 diesel fuel show a 25% soot's reduction.
4. Additive can enhance the stability of ethanol blended diesel fuel, and partly restore their viscosity.
5. Nitro Ethan restores the physicochemical properties of the diesel fuel is better than 2–Methoxy ethyl ether (MXEE) and Nitro Methane.
6. In comparing with standard diesel, when 10% Nitro Ethane is present, the average smoke generation rate reduces by 35.7%, in allengine modes. However, with Nitro Methane as additive, 16.2% reduction occurs.
7. The CO2, NOx increased with increasing percentage of ethanol in biodiesel-ignition improver blend.

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