Evaluation of Diesel-Hexanol Blend as Diesel Fuel

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Abstract

The effects of Deisel-hexanol blend were investigated. Diesel and oxygenated hydrocarbon (hexane) are blended in different percentage from 5%-45% by volume. These samples were characterized and the results show that 5% diesel-hexanol blend has very low anniline point, which is a measure of aromaticity responsible for particle emission. The lower the anniline point, the lower the emission of particles and this justifies the elimination of emission released into the environment by diesel-hexanol blend at 5%.

Keywords

Diesel-hexanol, Blend, Aromaticity, Emission, Anniline

Introduction

The ever-increasing environmental hazardous nature of the exhaust from incomplete combustion of diesel fuel engine on human health has necessitated the research into possible mean of eradicating such effects. Such environmental hazard includes particulate emission, as well as delayed ignition in temperate region and problem of low acceleration [Hoftman, 1980; Scheller, 1978].

Today, most of the countries in the world are importers of energy. The fossil fuels accumulated overseas of geological activity, are irreversibly concerned at rate more than million time faster than they were formed. This has left us in a precarious position especially for petroleum and its products.

Petroleum is broken down into many fractions after undergoing some separation and treatment processes [Dallasalvita P. A., 1982]. Petroleum products include gasoline (C_5 - C_{12}), kerosene (C_{10} - C_{16}), fuel and gas oil also known as diesel fuel (C_{15} - C_{22}), lubricating oil (C_{19} - C_{35}), paraffin wax and asphalt (C_{35} - C_{90}).

Diesel fuel is used in fueling automobiles, electrical generating plant and also fuel in heavy plants and agricultural equipment.

Diesel engine has particularly high levels of particulate, emissions and nitrogen oxides (NO). Particulate, or soot, are evident in many built-up urban centers because they soiled buildings and clothes.

These emissions are carcinogenic and cause serious respiratory problems. Moreover, since ozone is formed by the reaction of nitrogen oxide and hydrocarbons in sunlight, diesel emissions also contribute to ozone. Hence to eliminate the above-mentioned problem or disadvantages of diesel fuel in diesel engines, an oxygenated hydrocarbon (Hexanal) is blended in different proportion by volume with the diesel [Oke, 2002].

This wok was therefore undertaken to obtain emission free diesel fuel, with a view to:

- Study several existing direct fuel-alcohol blend.
- Produce diesel fuel-alcohol mixture capable of being used in diesel engine.
- Justify the diesel-alcohol blend.

Materials and Method

Preparation of sample: - Alcohol and diesel is blended in different ratios between 0% to 45% using a measuring cylinder. These mixtures are put in sampling bottle and are well shaken for homogeneity. The table 1 below shown the percentage of hexanol to the volume of Diesel.

Table 1. Ratio of the percentage of Hexanol to the Volume of Diesel Based on 200ml

S/N	Percentage of Hexanol	Vol. of Hexanol	Vol. of Diesel
1	0	0.0	200.0
2	5	10.0	190.0
3	10	20.0	180.0
4	15	30.0	170.0
5	20	40.0	160.0
6	25	50.0	150.0
7	30	60.0	140.0
8	35	70.0	130.0
9	40	80.0	120.0
10	45	90.0	110.0

Specific Gravity & API Gravity

The samples are poured into measuring cylinders of 250ml with the hydrometer suspended in the samples. The level at which the sample falls on the hydrometer is taken as the specific gravity. The temperature of the sample was taken along with hydrometer reading. API specific gravity is determined on specific gravity table at specified density and temperature.

Flash point

The flash point of a fuel is ignition point of a fuel (i.e. the temperature it will catch fire). The flash point of diesel is 150ºF or 65.6ºC. It is an important parameter for chacterizing fuel. Using an ASTM flash point tester does this. The cup of the tester was rinsed with the sample and small amount was put in the cup. The thermometer was also included in the set-up.

Anniline point

It measures the aromaticity content of the sample. These aromatics are responsible for the particular emission. These aromatics are hydrocarbons of branched chains. The hexanol helps the diesel hydrogen carbon to form straight chain and helps in compete combustion of the fuel.

10ml of anniline and 10ml of sample were measured and transferred to the U-tuber the temperature of homogeneity was recorded as the anniline point

The ASTM standard limit is 150ºC.

Diesel Index

Diesel index was determined for each sample using the equation below:

Diesel Index = (API gravity & Anniline point)/100

The ASTM standard is 47.

Distillation Range

This helps to determine the boiling range of the sample and the degree of contamination of each sample. The ASTM standard limit is between 340 - 337ºC. 100ml of a sample was measured into the distillation column and the temperature was taken for recovery of the sample.

Viscosity

Kinematic Viscosity is the measure of the resistive flow of fluid under gravity with the pressure head being proportional to the hydrostatic head. The pressure head of a liquid is proportional to its density. It has dimension of L^{o}/T where L is the length and T is time. Actually kinematics viscosity is the product of the measured flow time and the calibrated constant of the viscometer. The time was in minutes for a fixed volume of a sample flow through the capillary of a calibrated viscometer.

Results and Discussions

The result of the work is as shown in Table 2.

Table 2. Characteristics of Blended Samples Compared with ASTM Standard

Parameter	Standard ASTM	5%	10%	30%	35%	40%	45%
Density and Temperature at 30ºC minimum	0.820	0.850	0.850	0.850	0.850	0.835	0.835
Specific gravity at 15 ºC	-	860.3	860.3	850.3	845.4	845.3	845.3
API gravity	-	32.98	32.98	34.92	35.88	35.00	35.88
Boiling point ºC minimum	240	98	98	145	150	150	153
Flash point ºC minimum	65.5	73.3	68.9	65.6	65.0	65.0	65.0
Viscosity cSt cp	1.6-5.5	4.47	4.35	3.86	3.76	3.63	3.69
Diesel index minimum	47	52.1	44.5	40.16	38.75	37.67	35.88
Anniline point ºF min	154	158	150	108	105	100	90

Density

The minimum density standard is 0.820. From the experimental results all the samples have acceptable ASTM density with minimum being 0.835 for 35% through 45%. Others have 0.850 densities. This shows that by the density all the samples are accepted.

Boiling Points/Boiling Range

The minimum boiling point by ASTM standard is 240ºC and ranged between 240-387ºC. By this factor none of the sample falls within the standard, meaning high degree of impurities and also shows that the samples are too light.

Flash Point

The minimum flash point accepted by ASTM is 65.5ºC. The results show that 5%, 11%, 30% samples have accepted value. Hence such sample can be used as diesel fuel considering all other factors.

Viscosity

The accepted standard for viscosity by ASTM is between 1.6-5.5cp for diesel index to the diesel-hexanol blends fall within this range.

Diesel Index

The minimum value for diesel index is 47 by ASTM. Only 5% sample that falls within the accepted value of 52.1, other are not up to accepted value.

Anniline Point

The minimum anniline temperature by ASTM is 154ºF. Anniline point is a measure of aromaticity responsible for particle emission. The lower the aniline points the lower the emission of particles. Only 5% diesel-hexanol blend meets this standard with a value of 158 which justifies the aim of this work. Others are below 150 - 90 for samples 10% - 45% respectively.

Conclusion

The results of this study demonstrate that 5% diesel - hexanol blend going by ASTM standard falls within the standard especially the aniline point that measures the rate of particle emission falls within the minimum standard. The lower the aniline points the higher the elimination of emission. Only boiling point falls below the standard. Therefore, the 5% diesel - hexanol blend is recommended if it can be improved upon since it will provide a major means of reducing environmental pollution and cost.

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Section 4

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