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BLENDABILITY AND PROPERTY OF TURPENTINE OIL WITH PETROL AND DIESEL

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ABSTRACT

Pollution from the petroleum oil is increasing day by day in terms of CO_2, CO, NOX, and many other gases and particles. Price difference and economy leads people toward the use of alternative fuels. To overcome this problem turpentine oil is mixed with petrol and diesel and taken as different samples. Then the properties like flash point, fire point, cloud and pour point, calorific value, carbon content test, ash content test, copper corrosion test are analyzed at various proportions of turpentine oil (5%, 10%, 15%, 20% of 100 mL sample) blended with petrol and Diesel fuels. Any other type of substance, can be assigned some physical and chemical properties (e.g. density, thermal capacity, vapour pressure, chemical formula, etc). However, most of the times, combustion properties are also assigned to blended fuels, in spite of the fact that these properties depend on the oxidizer (e.g. air, pure oxygen) and the actual process (e.g. the explosion limits depend on the boundary conditions for a given fuel/oxidizer pair). Fuel price, availability, risk, and so on, could also be considered fuel properties (attributes).

Key words: Petrol, Diesel, Turpentine oil.

INTRODUCTION

The single largest source of energy of energy in India after coal is petroleum. About two-third of which is imported. The petroleum derived fuel, i.e. motor gasoline and diesel are being used almost by the entire road transport vehicles. The diesel fuel is also being used in agriculture operations. The high dependence on important outside source of energy is an issue related to energy security of the country. In the recent time, the combustion of these fossil fuels has been recognized as a major cause of air pollution in Indian cities. We therefore need to look for cleaner alternatives, which could not only reduce pollution but

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also reduce our dependence on imports. In order to overcome the disadvantages of using petrol and diesel, we can go for an alternative fuel blends with petrol and diesel at various proportions.

10% ethanol blends can be effectively used without modification in air/fuel system. CO, HC emissions can reduce by using different % of blends of ethanol in gasoline. Among, which 10% is the best one to be used in multi cylinder engines without any alteration to reduce exhaust[1]. This study provides a comprehensive assessment on LPG enrichment of petrol and its blends in terms of their performance and emission aspects. The review shows that the LPG using in IC engines reduces the emissions, which is the most important criterion for the current environmental norms[2]. In the process for the extraction of rosin from resinous wood, there are also recovered substantial quantities of pine oil and turpentine[3]. Based on the exhaustive engine tests, it can be concluded that biodiesel can be adopted as an alternative fuel for the existing conventional diesel engines without any major modifications required in the system hardware[4].

Turpentine oil

Turpentine is oil obtained from pine trees, and is different from the mineral turpentine that can be bought in the supermarket. It is a very important substance with many applications as a solvent, in the pharmaceutical industry and in the production of oils, resins and varnishes. It is also used as the starting material to manufacture a variety of other products, including pine oil and turpentine. Turpentine is initially separated from wood chips after they have been "cooked" in the kraft paper-making process. It is separated off as a mixture of water and turpentine vapors, which separate out when left to separate in a tank, as turpentine is much lighter than water. This turpentine is then distilled into "heads" (volatile compounds with no commercial value), and α - and ß-pinene. Of these, ß-pinene is sold as is and α-pinene is further processed to make pine oil by reacting it with phosphoric acid. A further, less valuable, solvent, dipentene, is produced as a by-product of this process.

Table 1: Properties of Fuels

S. No.	Properties	Diesel	Petrol	Turpentine oil
1	Density (kg/m$^{3)}$	830	750	854
2	Flash point (^{o}C)	> 52	– 43	35
3	Calorific value (kJ/kg)	44800	48000	44000
4	Specific gravity	0.83	0.82	0.85
5	Viscosity (m^2/s)	3×10^{-6}	0.5×10^{-6}	1.5

Turpentine oil blended with diesel and petrol

Petrol and diesel is blended with turpentine oil with volume fractions of 5%, 10% 15% and 20% of turpentine oil. The volumetric composition detail about the samples prepared is listed in Table 2. These blended samples are tested for various property values that state whether they can be used in the engine as regular fuel or not.

Table 2: Samples at different volume fractions

Samples	Diesel and petrol (%)	Turpentine oil (%)
I	95	5
II	90	10
III	85	15
IV	80	20

EXPERIMENETAL

Transesterification process of biofuel

The transesterification process is a procedure followed to convert virgin oils into a fuel suitable to use in automobiles. The process begins with the heating of raw oil along with 100 mL of methanol and potassium hydroxide to a temperature of about 135^{o}C. This will create a mixture blended within all the components and allowed to get settled for 24 hrs.

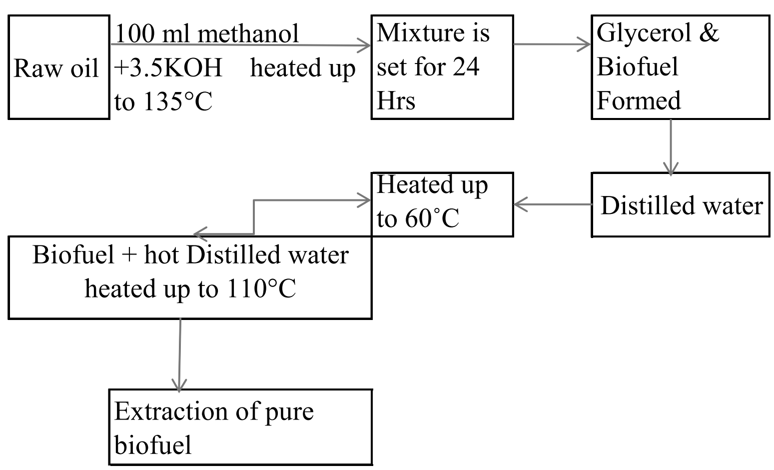

Fig. 1: Flow chart of the transesterification process

The component will undergo chemical deterioration and form biofuel along with glycerol. The mixture is then heated with distilled water for a known time period such that the glycerol reacts with water. The water with glycerol is further heated up to 110°C to extract pure biofuel.

RESULTS AND DISCUSSION

Variation of flash and fire point

Flash point of the oil is the temperature at which the oil starts forming vapors but not sufficient enough to sustain a flame. Fire point of the oil is the temperature at which the oil has started producing enough vapors to sustain a flame. The flash point and fire point of the given sample oil is measured using Abel's Open cup Apparatus. It is evident from the Fig. 2(a), that the flash point and the fire point for the blended samples of diesel is decreased as the concentration of turpentine oil on the sample is increased.

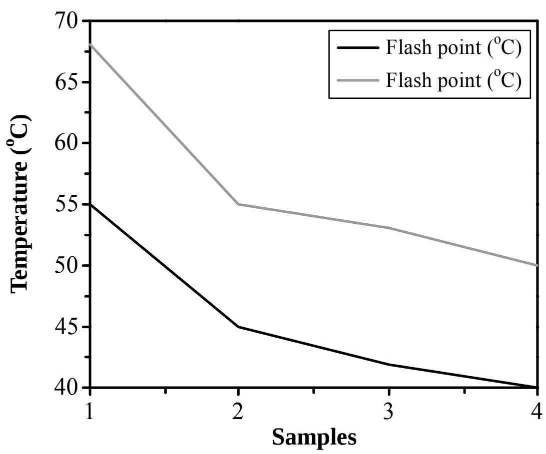

Fig. 2: Flash and fire point graph for diesel blends

Variation of cloud and pour point

The cloud and pour point temperature of samples are determined using cloud and pour apparatus. The cloud point of a fluid is the temperature at which dissolved solids are no longer completely soluble, precipitating as a second phase giving the fluid a cloudy appearance. Whereas, the pour point of a liquid is the lowest temperature at which it becomes semi solid and loses its flow characteristics. From Fig. 3(a), the cloud point shows a decreasing nature of cloud point with the increase in concentration of turpentine oil on the diesel. However, the pour point shows a varying nature of increasing and decreasing alternately. As for the petrol samples are concerned, values of both cloud and pour points show an increasing trend with increased concentration of blending oil. It is shown clearly in the Figure 3(b).

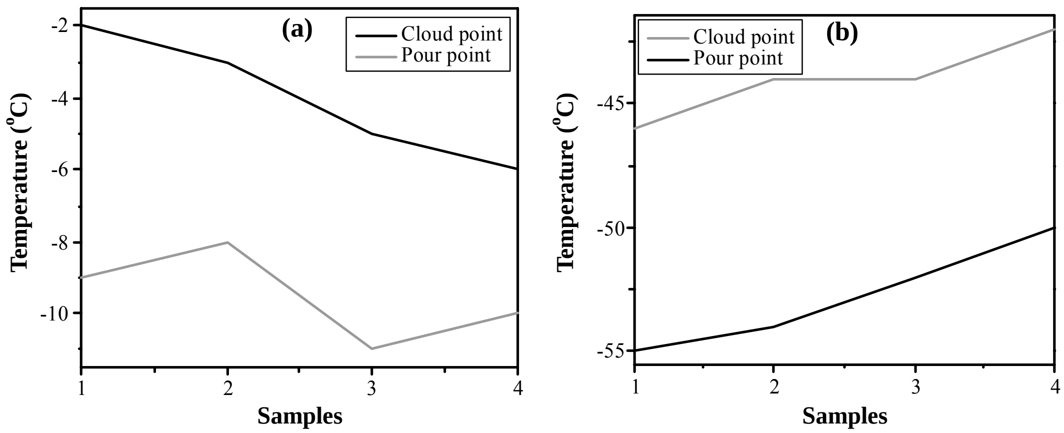

Fig. 3: (a) Variation of cloud and pour point for diesel blends (b) Variation of cloud and pour point for petrol blends

Variation of carbon residue

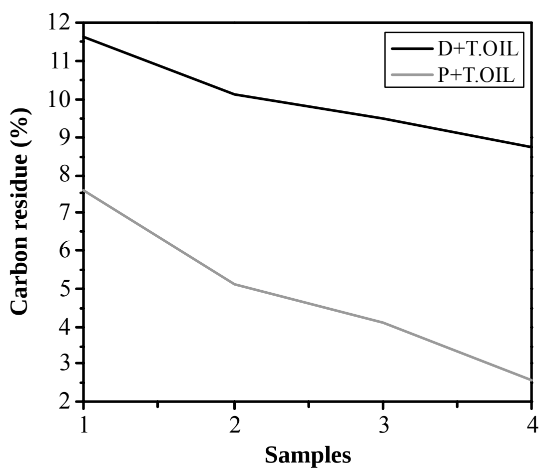

Fig. 4: Carbon residue test plot

The residue of carbon present in the samples is determined from the carbon residue test apparatus. It is the amount of carbon residue left after evaporation of given samples in the test apparatus, which is heated in the furnace for a known period of time and cooled in desiccators. Any foreign particle adhering to the bulb is brushed off with the piece of sized paper or camel hair brush. The left out is weighed to the nearest 0.1 mg value accurately. The Figure 4 shows, that the carbon residue of the blends with petrol and diesel are decreasing with increasing volume of turpentine oil in the sample. For petrol blends there is steep fall in the carbon residue value but only a gradual decrement in the diesel samples.

Variation of ash content test

The crucible weighing method is used to determine the amount of ash content in the given fuel sample. The weight of the crucible is noted before and after the fuel sample is filled. Then it is fired in open air inside a furnace to a temperature of 550 - 600 ^{0}C (Depending on the sample). After complete burning, the crucible is removed from furnace and weight is noted. By simple calculation, the ash content of the samples are estimated and plotted as shown in Figure 5. The ash content of the diesel blends show a gradual fall in value whereas there is steep rise for blends formed of petrol.

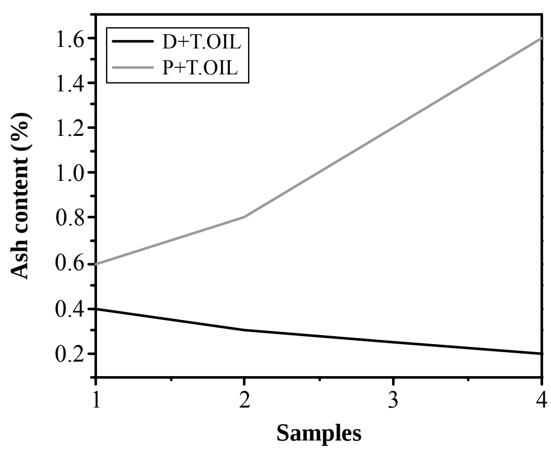

Fig. 5: Ash content test graph

Variation of vapor pressure

The vapor pressure of each sample is determined by using the Reid vapor pressure gauge. The sample is placed in the chamber and pressure gauge is connected to it. It is then heated to 37.8°C for not less than 10 min by immersing it in the hot water bath. Finally, the vapor pressure is measured at different time intervals and results are plotted in the Fig. 6.

Variation of corrosion property

The method of detecting the corrosiveness to copper of aviation given samples having Reid vapor pressure no greater than 18 lb is followed. Carefully slide the sample tube into the test bomb which is filled with known amount of sample. It is then heated to 100 ± 1°C for about 120 ± 5 min and is cooled. Now, the test tube is withdrawn and examined with respect to the standard chart shown in Fig. 7. The corrosion property of each sample is listed in Table 3.

Table 3: Corrosion property of samples

Sample	Diesel + Turpentine oil	Petrol + Turpentine oil
1	1b (slight tarnish)	1a (slight tarnish)
2	2c (moderate tarnish)	1b (slight tarnish)
3	3a (dark tarnish)	2c (moderate tarnish)
4	3a (dark tarnish)	3b(dark tarnish)

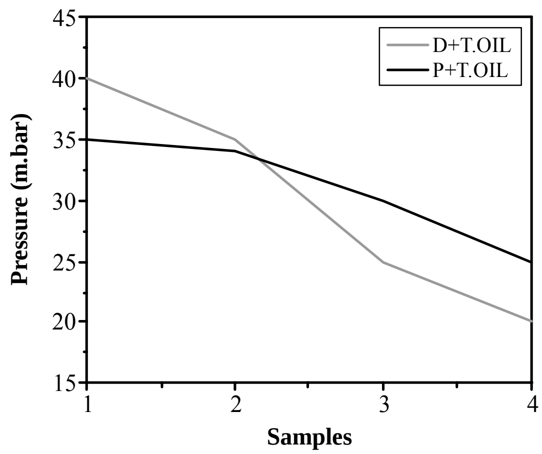

Fig. 6: Reid vapor pressure test graph

Fig. 7: Copper strip corrosion standards

CONCLUSION

Petrol and diesel with 5%, 10% 15% and 20 % of turpentine oil blends are prepared. These samples exhibit different properties and posses different chemical properties. Therefore, the properties of the samples are observed and investigated and the properties of the samples vary from the original and some of the values increase and decrease.

(i) The flash point and fire point of the diesel samples decreases.

(ii) Also cloud point pour point, calorific value, carbon content, ash content, vapor pressure decreases when compared to standard values of petrol.

(iii) The cloud and pour point, ash content increases for the petrol sample.

(iv) Whereas the carbon content, calorific value, vapor pressure is decreased when compared to standard values of petrol.

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