Acetone as a Gasoline Additive

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Abstract— An experimental investigation was performed to find out the change in properties of gasoline by blending of acetone in fuel. The additive is a liquid which is add in the fuel to improve their properties which is responsible for combustion in engine. The addictive improve fuels burn rate, increase surface area, prevent corrosive effects and increase the efficiency of engine The main objective of experiment to find effect of acetone on properties of fuel. acetone is readily available chemical added in gasoline to improve the fuel ability to vaporize completely by reducing the surface tension it increases the mileage, increases power, engine life and performance, less unburned fuel going past the rings keeps the rings and engine oil in far better condition it can stop the black smoke when the rack is all the way at full throttle it can reduces hydrocarbon emission. it can reduce the formation of water ice crystals in below zero weather which can damage the fuel filter. Form the experiment it's found that The kinematic viscosity ,Surface tension and HC emissions is reduces by blending acetone in gasoline .But the only one thing is increases that is mileage of vehicle.

Key words: Gasoline, Surface Tension, Viscosity, Emissions, Mileage, Blending

I. Literature review

A. Groysman et al. he was stated that properties of fuels can be improved, maintained or imparted new beneficial characteristics by the adding of small amounts of certain chemicals named fuel additives. Fuel additives are added in very small concentrations: from several ppm to several thousand ppm. It is important that additives which improve some properties should not deteriorate other properties of fuels and its quality in general.

Talkit .K.M et al. investigation was performed to find out the fuel properties including kinematic viscosity, acid value and density of convectional diesel fuel, biodiesels (100% methyl ester of soybean oil, 100% methyl ester of groundnut oil) and their blends with acetone having blending ratio 95%, 85%, 75% and 65%. In the present research work, reduces the kinematic viscosity of biodiesels

Diego A.Ruiz et al.he was stated that the fuel additive that provides increased fuel eficiency, While at the same time reduces harmful emissions from combustion engines. The fuel additive is a combination of a synthetic oil blend, ethyl acetate and acetone. In one particular implemen tation, the amount of acetone is equal to at least 10% of an overall volume of the additive.

Mahajan .D.T et al.invest that the kinematic viscosity of test fuels and its blends decreases linearly with increasing temperature and increasing blending ratio of acetone. The density and acid value of test biodiesels also decreases with increasing blending ratio of acetone.

R.G.Temple et al. This work showed that combinations of oxygenates including alcohols, ethers and ketones can be highly advantageous in raising octane ratings by 3 or 4 without modification to engine and fuel system. Lower exhaust emissions are to be expected with more oxygen in the fuel and these and improved power output are additional benefits.

Patil Milind S. et al. investigated performance test for I.C. engine using blends of ethanol and kerosene with diesel. From the results obtained, it observed that for 20% mixture of ethanol blend with diesel has a very good efficiency compared with pure diesel and ethanol blend. Also it was observed that the 20% ethanol blend is having higher volumetric efficiency compare with diesel and kerosene blends.

II. Introduction

Most fuels such as gasoline, kerosene (jet fuel), gas oil (diesel fuel) and fuel oil have their drawbacks which do not allow their long term storage, make difficult transportation and even use. About 20 properties of fuels can be improved, maintained or imparted new beneficial characteristics by the adding of small amounts of certain chemicals named fuel additives. There is various additive are available. Acetone is one of these, it is colorless, volatile liquid with a sweet odor. It can occur naturally. Acetone will also readily volatilize and biodegrade in soil. Acetone drastically reduces the surface tension of gasoline. Most fuel molecules are sluggish with respect to their natural frequency. Acetone has an inherent molecular vibration that "stirs up" the fuel molecules, to break the surface tension.

Fig. 1: Acetone Bottle

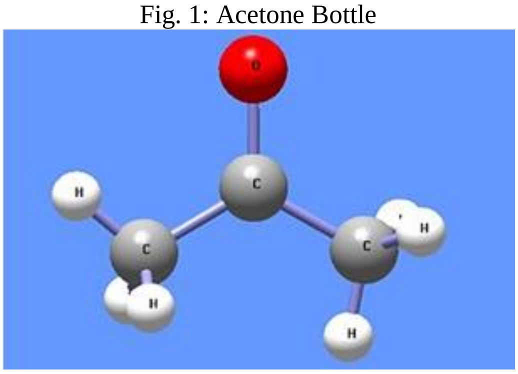
Fig. 2: Acetone Chemical Structure

This results in it increase the ability of fuel to vaporize completely by reducing the surface tension it increases the mileage, increases power, engine life and performance, less unburned fuel going past the rings keeps the rings and engine oil in far better condition it can stop the black smoke when the rack is all the way at full throttle it can reduces hydrocarbon emission. it can reduce the formation of water ice crystals in below zero weather which can damage the fuel filter.

It is important to mention that sometimes oxygenates (ethers and alcohols) which are added to gasoline in large amounts (up to 15 % vol.) are thought of as additives. They are not additives and are the competent components of gasoline. Fuel additives are added in very small concentrations: from several ppm to several thousands ppm (1 ppm = 0.0001 wt%). In such way, they are similar to corrosion inhibitors which also are added in small amounts in different media and significantly diminish their corrosivity. Usually such small amounts of additives are not reflective of the bulk composition of the mixture (fuels), but can significantly influence their properties. It is important that additives which improve some properties should not deteriorate other properties of fuels and its quality in general. Fuel additives are organic substances soluble in fuels . Some of these additives may help to maintain fuel quality (e.g., antioxidants, stabilizers, corrosion inhibitors, and biocides). Others may aid the movement of fuel through the distribution chain and into the vehicle tank (e.g., flow improvers, pipeline drag reducers, demulsifiers, and antifoams); may be added for legal reasons (e.g., dyes and markers) or can address specific concerns from motor manufactures (e.g., deposit control additives and lubricity improvers). We will describe fuel additives and how they work.

A. Action of Fuel Additives and Their Application

Use of gasoline fuel additives largely reflects developments in engines design and refinery operations, as well the problems occurring during storage and transportation of gasoline. Use of kerosene (jet fuel) additives reflects strict requirements to maintain properties of jet fuel. Use of diesel fuel additives reflects the impact of growing diesel fuel demand and the changing technology of diesel engines. Sometimes additives are divided according to the name of fuel: gasoline, jet fuel, diesel fuel and fuel oil additives. It is conditionally because the same additives (e.g., antioxidants and corrosion inhibitors) can be used in gasoline, jet fuel, and diesel fuel. Situation with aviation fuels (jet fuel and avgas) is unique in that only those additives specifically approved may be added to jet fuel. Before an additive can be approved for use in aviation fuel, it must undergo extensive testing to show both that it is effective and that it does no harm to any other fuel properties. To guard against harmful additive interactions, an additive must be tested at four times its maximum dosage in the presence of other additives before it is approved.

B. Action of Fuel Additives and Their Application

Antifoams All diesel fuels have a natural tendency to produce foam when pumped from a service tank into a vehicle's tank. This tendency is overcome by addition of polysilicone compounds.

Anti-icing additives Water in its liquid state is not only the cause of corrosion of metallic equipment and structures. In jet fuel or avgas, water turns into ice at temperatures below 0 °C. Ice can form from dissolved water in fuel tanks at low temperatures during flights at high altitude. The freezing point of jet fuel is − 47 °C at pressure 1 atm. If free water is present in jet fuel, it will turn into ice at T <0 °C while the jet fuel is still liquid. The ice crystals can prevent fuel flow and possibly starve the engine for fuel. After the 1958 crash of a B-52 attributed to ice in the fuel, causing five of its eight engines to fail due to fuel starvation, anti-icing additives were introduced into military aviation fuels in the early 1960s.

To illustrate how the freezing point of water can be lowered, I describe three reallife incidents. In Siberia (Russia) in winter, where the air temperature was − 45 °C, I saw that car drivers did not use pure water for cooling their car engines. They added a solution called 'antifreeze', containing organic liquid alcohols—ethylene glycol or di-ethylene glycol—to their cars' cooling water in order to reduce the freezing point of the water used in their radiators. An 'antifreeze' is an additive (chemical compound) that lowers the freezing point of water. In Moscow's cold winters (the second example), I saw that table salt (NaCl) powder was dispersed on icy roads in order to lower the freezing point of water; namely, to turn ice into liquid water. Thus the ice combined with the salt turns into a liquid aqueous solution. The ice did not freeze at − 5 °C and even at − 10 °C to − 15 °C, and as a result, cars and people could move without danger of slipping, skidding, falling and accidents. The third example of use of de-icing solutions concerns flight in winter when the temperature is around 0 °C. Once on a winter flight when I was inside the airplane, waiting to takeoff, I observed how de-icing (removal of snow, ice and frost from a surface) of both wings was done by spraying aircraft with a de-icing fluid. This fluid was based on propylene glycol, similar to ethylene glycol antifreeze used in some automobile engine coolants. Ethylene glycol is still in use for aircraft de-icing in some parts of the world because it has a lower operational use temperature than propylene glycol, but propylene glycol is more common because it is classified as non-toxic, unlike ethylene glycol. The de-icing solution not only de-iced the surface at the moment when it was applied, but also remained on the surface and continued to delay the reformation of ice for a certain period of time and prevents adhesion of ice. Hence, I was sure that our departure and flight would be safe. What is common between these three examples?

The freezing point of a solution is lower than that of a pure solvent. This phenomenon is based on thermodynamic properties of solutions. The decrease of a freezing temperature of a solution is proportional to the concentration of a solute (added substance) in a solution that is composed of ethylene glycol, propylene glycol or salt in an aqueous solution.

III. EXPERIMENT

A. Viscosity Measurement

Viscosity of neat gasoline and blend with acetone measured by Ostwald's viscometer.

According to this test firstly take the Ostwald's viscometer fill the water in it from one end and suck the water from another end up to upper mark release it and simultaneously start the stopwatch and measure the time required to reach level of water to lower mark. Make the sample of blending of acetone in fuel

Well stir it and repeat the experiment on samples same like water and note the time. The kinematic viscosity is measured by following equation.

Viscosity of Samples = ((ds x ts)/dw x tw)x Ƞw

Where

ds = Density of sample

ts = traveling time for sample

dw = Density of water

tw = traveling time for water

Ƞw = Viscosity coefficient of Water

Sr. No	Acetone blending pre litre	Kinematic viscosity (Poise)
1	Unblended (0 ml)	0.0125
2	1 ml	0.0095
3	2 ml	0.0090
4	3 ml	0.0092

Table 1: Results

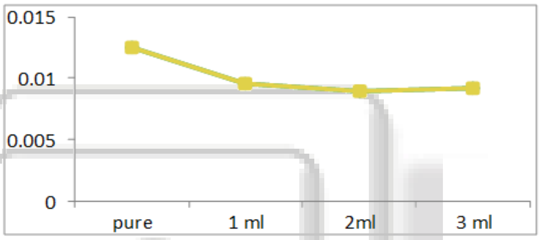

Fig. 3: Viscosity Graph

B. *Surface Tension Measurement*

The surface tension of the pure gasoline and blended gasoline is measured by capillary rise method .according to experiment make the sample for the measurements take the biker fill the sample in it deep the capillary in it and note the height of rise of liquid by the traveling microscope. And note the rise of liquid. The surface tension is measured by following equation.

T=rhdg/2cosϴ

Where

T= Surface tension

r = Radius of caparilry

h= raise of liquid

d = density of liquid

g = gravitational Acceleration .9.81N/M

ϴ = Angle of contact

Sr.No	Acetone blending pre litre	Surface tension
1	Unblended(0 ml)	0.4138
2	1 ml	0.3825
3	2 ml	0.3656
4	3 ml	0.3491

Table 2: Results

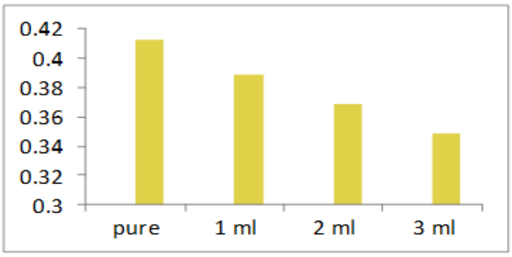

Fig. 4: Graph Surface Tension

C. *HC Emission Measurement*

The emission of the engine for the neat gasoline and blended gasoline is measured by the exhaust gas analyzer. The emission test is perform on the horiba gas analyzer which is measure the amount of exhaust by the engine .to take the test firstly make the sample of pure gasoline and blended gasoline with acetone of 1 ml, 2 ml,3 ml per liter. Fill this sample fuel in the fuel tank of vehicle and start the engine, insert the probe of analyzer in the silencer of vehicle an note the reading of HC emission .repeat this procedure for all samples.

Sr. No	Acetone blending pre litre	HC Emission PPM Vol
1	Unblended(0 ml)	1499
2	1 ml	720
3	2 ml	710
4	3 ml	702

Table 3: Results

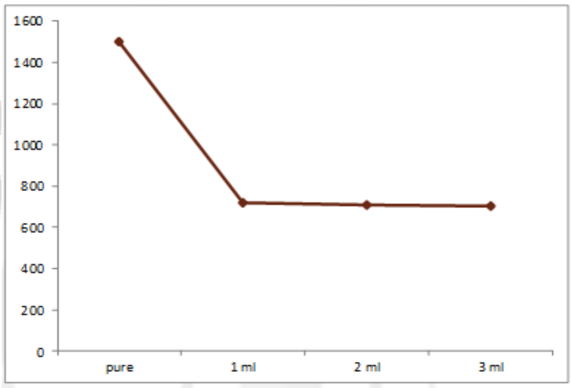

Fig. 5: Graph. HC Emission

D. *Milage Measurement*

The mileage measurements are carried on the vehicle with its all operating condition. For carried out the mileage test firstly make the sample of pure gasoline and blended gasoline with acetone of 1 ml,2 ml,3 ml per litre .Fill this sample fuel in the fuel tank of vehicle and start the engine, drive the vehicle until the fuel tank is empty .note down the distance travel by vehicle on this fuel. Repeat this procedure for all samples.

Sr.no	Acetone blending ratio per liter	Milage (km/ltr)
1	Unblended (0 ml)	60
2	1 ml	61
3	2 ml	64
4	3 ml	62

Table 3: Results

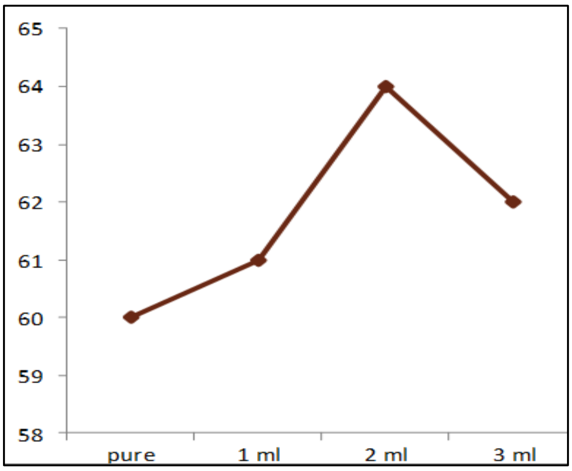

Fig. 6: Graph of Mileage

IV. CONCLUSIONS

In order to investigate the effect on properties of gasoline by Blending of acetone in pure fuel, the properties and the performance of vehicles is changes with blending ratio of acetone. from the result of tests is conclude that

1) The kinematic viscosity measured decreased proportionally with the increase in blending ratio of acetone. The viscosity for the unblended gasoline is 0.0125 but it changes for blending of acetone ,for 1 ml is 0.0095 for 2 ml is 0.0090 .hence from above data it is conclude that kinematic viscosity is decreased by adding acetone 1 and 2 ml.
2) The surface tension measured decreased proportionally with the increase in blending ratio of acetone. The surface tension for the unblended gasoline is but it changes for blending of acetone ,for 1 ml is 0.4120 for 2 ml is 0.3656 and for 3ml is 0.3491.hence from these data's, it's should be conclude that fuel property such as surface tension should be improved by acetone blends.
3) The HC emission measured decreased linearly with the increase in blending ratio of acetone. The HC emission for the unblended gasoline is 1499 but it changes for blending of acetone ,for 1 ml is 720 for 2 ml is 710 and for 3ml is 702 .hence from these data's, it's should be conclude that HC emissions is redused by blending of acetone.
4) The milage measured of vehicle is increases proportionally with the increase in blending ratio of acetone. The milage for the unblended gasoline is 60 but it changes for blending of acetone, for 1 ml is 61, for 2 ml is 64 and for 3m is 62 km/ltr.hence from these data's, it's should be conclude that milage of vehicle is improved by acetone blends.

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