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Copper Strip Corrosion Test for Different Fluid Samples

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Abstract :- *Current research work is done in order to determine the corrosiveness test using different fluid samples in state of Telengana (India). The puropse of this experiment is to determine the the corrosiveness test of fuels. This determination will be accomplished by using copper strip corrosion test. By using the copper strip experiment we can find the corrosive propertyof the fuel and hence the efficiency of fluid samples collected. This project covers the importance of knowing the corrosive property of different fluid samples collected.*

Keywords: - *Corrosion, Copper strip, Fluid.*

I. INTRODUCTION

Corrosion of metal in the presence of water is a common problem across many industries. The fact that most oil and gas production includes co-produced water makes corrosion a pervasive issue across the industry. Age and presence of corrosive materials such as carbon dioxide (CO_2) and hydrogen sulfide (H_2S) exacerbate the problem. The definition of copper strip corrosion can be stated as a qualitative method that is used to determine the level of corrosion of petroleum products. In this test, a polished copper strip is suspended in the product and its effect observed.

The method is well suited for specification settings, internal quality control tools and development and research on aromatic industrial hydrocarbons. It also detects the presence of harmful corrosive substances, like acidic or sulfur compounds, which may corrode the equipment. Copper strip corrosion is also known as the copper strip test. This test can be used for testing gasoline, solvents, natural gasoline, kerosene, diesel fuel, distilled fuel oil and lubricating oil, among other products, using test baths. At elevated temperatures, a copper strip that has been polished is immersed in a sample, usually 30 ml. The strip is then removed and tested for corrosion and a classification number is given. The number ranges from 1 to 4 after a comparison with the ASTM copper strip corrosion standard is done. There are several methods and tests available. One is the test bomb bath, 7151K59. In this test a thermostatically controlled water bath is used to immerse copper strip corrosion test bombs. This must be done at the right depth as per the ASTM requirements. This test has several specifications that are identified with it:
Testing up to four copper strips at a time
Maximum temperature of 221°F (±1°F)/105°C (±0.5°C)
This can be used to test samples which do not require a test bomb. These include diesel fuel, automotive gasoline, fuel oil, Stoddard solvent, kerosene, and lubricating oil [1].

1.1 Petrol

Gasoline known as petrol outside North America is a transparent, petroleum-derived liquid that is used primarily as a fuel in internal combustion engines. It consists mostly of organic compounds obtained by the fractional distillation of petroleum, enhanced with a variety of additives. On average, a 42-gallon barrel of crude oil (159 L) yields about 19 US gallons (72 L) of gasoline when processed in an oil refinery, though this varies based on the crude oil source's assay. The characteristic of a particular gasoline blend to resist igniting too early (which causes knocking and reduces efficiency in reciprocating engines) is measured by its octane rating. Gasoline is produced in several grades of octane rating. Tetraethyl lead and other lead compounds are no longer used in most areas to regulate and increase octane-rating, but many other additives are put into gasoline to improve its chemical stability, control corrosiveness and provide fuel system 'cleaning,' and determine performance characteristics under intended use. Sometimes, gasoline also contains ethanol as an alternative fuel, for economic or environmental reasons.

1.2 Diesel

Diesel fuel in general is any liquid fuel used in diesel engines, whose fuel ignition takes place, without any spark, as a result of compression of the inlet air mixture and then injection of fuel. (Glow plugs, grid heaters and heater blocks help achieve high temperatures for combustion during engine startup in cold weather.) Diesel engines have found broad use as a result of higher thermodynamic efficiency and thus fuel efficiency. This is particularly noted where diesel engines are run at part-load; as their air supply is not throttled as in a petrol engine, their efficiency still remains very high. The most common type of diesel fuel is a specific fractional distillate of petroleum fuel oil, but alternatives that are not derived from petroleum, such as biodiesel, biomass to liquid (BTL) or gas to liquid (GTL) diesel, are increasingly being developed and adopted. To distinguish these types, petroleum-derived diesel is increasingly called petrodiesel. Ultra-low-sulfur diesel (ULSD) is a standard for defining diesel fuel with substantially lowered sulfur contents. As of 2016, almost all of the petroleum-based diesel fuel available in UK, Europe and North America is of a ULSD type. In the UK, diesel fuel for on-road use is commonly abbreviated DERV, standing for diesel-engine road vehicle, which carries a tax premium over equivalent fuel for non-road use. In Australia diesel fuel is also known as distillate, and in Indonesia, it is known as Solar, a trademarked name by the local oil company Pertamina.

1.3 Kerosene

Kerosene, also known as paraffin, lamp oil and coal oil (an obsolete term), is a combustible hydrocarbon liquid which is derived from petroleum, widely used as a fuel in industry as well as households. Its name derives from Greek, meaning wax, and was registered as a trademark by Abraham Gesner in 1854 before evolving into a genericized trademark. The term kerosene is common in much of India, Canada, the United States, Argentina, Australia and New Zealand and the term paraffin is used in the United Kingdom, Southeast Asia, East Africa and South Africa. Liquid paraffin (called mineral oil in the US) is a more viscous and highly refined product which is used as a laxative. Paraffin wax is a waxy solid extracted from petroleum. Kerosene is widely used to power jet engines of aircraft (jet fuel) and some rocket engines, and is also commonly used as a cooking and lighting fuel and for fire toys such as poi. In parts of Asia, where the price of kerosene is subsidized, it fuels outboard motors on small fishing boats. World total kerosene consumption for all purposes is equivalent to about 1.2 million barrels per day

1.4 Aviation Turbine Fuel (Atf)

Is a type of aviation fuel designed for the use in aircraft.the most commonly used for commercial aviations are JET A & JET A-1

1.5 Superior Kerosene Oil (Sko)

Kerosenes are distillate fractions of crude oil in the boiling range of 150- 250°C. They are treated mainly for reducing aromatic content to increase their smoke point.

II. COPPER

Pure copper is a reddish, highly malleable metal, and was one of the first to be found and utilized. Copper and its alloys are widely used because of their excellent electrical, thermal conductivities, outstanding resistance to corrosion, ease fabrication and broad ranges of obtainable strength and special properties. Copper and copper alloys comprise one of the broadest and most versatile groups of engineering materials. Almost 500 copper alloys are currently recognized and are classified under international standard. Copper alloys are produced in all common forms.

Choosing the correct alloy is simplified by the fact that copper metals are normally chosen for particular physical or mechanical properties and alloys with the desired properties can easily be sorted out. The main reason why copper and its alloys are so widely used is that they offer a better combination of useful properties that cannot be found in other material

III. EQUIPMENT DESCRIPTION

Fig.1 Copper strip corrosion apparatus

The apparatus we used is copper strip corrosion test apparatus. It is actually an Owen where we can change the temperature as we like for the experiment. The apparatus consists of a bath either dual purpose (50 deg C & 100 deg C) or a boiling bath (100 degC only) without stainless steel bomb and copper strips of definite size 6 bombs or 18 test tubes can be accommodate in each type of bath with different temperature regulation system to operate on 220 volts AC. mains.

IV. PROCEDURE

- TAKE THE OIL SAMPLES TO BE TESTED WITHOUT FILTERING.
- Place the copper strip in a clean 250 ml bottle in which 250ml of oil to be added.
- Place the copper strip standing on its long edge.
- Lubricate the ground glass stopper with a small amount of sample
- Bubble nitrogen through the oil by a glass tube connected to the needle valve of the cylinder
- Place the stoppered bottle in the oven at 140 °C
- Remove the bottle after heating for 19hrs at 140 °C
- Carefully take the copper strip from flask and wash with acetone.
- Hold the test stripe in such a manner that the light reflected it an angle of approximately 45 °C

V. OBSERVATION

Table.1 Inference

S.NO	Samples used	Initial Wt. of the copper strip W1,gm	Final Wt. of the copper strip W1,gm	Difference between initial and final (W2-W1)gm	Percentage (W2-W1)/w1*100
1	ATF	1.4	1.9	0.5	35.7%
2	SKO	0.9	1.25	0.35	38.8%
3	PETROL	1.05	1.27	0.22	20.9%
4	KEROSENE	1.4	1.52	0.12	8.5%
5	DIESEL	1.4	1.59	0.19	13.5%

IV. CALCULATION

- For Superior kerosene oil (SKO) Weight of copper strips used =0.9gm
- For Aviation Turbine Fuel (ATF) Weight of copper strips used =1.4gm
- Calculation for efficiency of ATF After 19hrs of experiment the weight of the copper strip = 1.9 gm
  Efficiency of ATF = (1.9-1.4)/1.4*100 =35.7%
- Calculation for efficiency of SKO After 19hrs of experiment the weight of the copper strip = 1.25 gm
  Efficiency of SKO = (1.25-0.9)/0.9*100 =38%
- Calculation for efficiency of petrol After 19hrs of experiment the weight of the copper strip = 1.27 gm
  Efficiency of petrol = (1.05-1.27)/1.05*100=20.9%
- Calculation for efficiency of kerosene

After 19hrs of experiment the weight of the copper strip = 1.52 gm Efficiency of kerosene = (1.4-1.52)/1.4*100 = 8.5%

- Calculation for efficiency of diesel After 19hrs of experiment the weight of the copper strip = 1.59 gm
  Efficiency of diesel = (1.4-1.59)/1.4*100 = 13.5%

IV. CONCLUSION

The corrosiveness present in the samples I, II, III, IV & V are 35.7%, 38%, 20.9%, 8.5% & 13.5% respectively.

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