International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 6, Issue 3 (March 2017), PP.33- 37

Comparison Of Corrossion Resistance Of Copper For Samples

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Abstract :- In order to ensure smooth and uninterrupted flow of oil and gas to the end users, it is imperative for the field operators, pipeline engineers, and designers to be corrosion conscious as the lines and their component fittings would undergo material degradations due to corrosion. This paper gives a comprehensive review of corrosion problems during oil and gas production and its mitigation. The chemistry of corrosion mechanism had been examined with the various types of corrosion and associated corroding agents in the oil and gas industry. Factors affecting each of the various forms of corrosion were also presented. Principles of corrosion must be understood in order to effectively select materials and to design, fabricate, and utilize metal structures for the optimum economic life of facilities and safety in oil and gas operations. This test method covers the determination of the corrosiveness of copper by the petroleum products.

Keywords: - Corrosion, Fuel, Metals, Oil, Copper strip.

I. INTRODUCTION

Crude oil is an organic liquid substance often found below the Earth's surface. It is made up of thousands of molecules composed of different hydrogen and carbon atoms. Such compounds are called hydrocarbons. These hydrocarbons also contain different proportions of impurities like oxygen, sulphur, nitrogen and heavy metal atoms. The word 'petroleum' is derived from the Latin petra (which means rock) and oleum (which means oil). It is commonly used to refer to crude oil, but it may also refer to other related hydrocarbons. Some hydrocarbons are gaseous, rather than liquid. Methane is the most common example of these hydrocarbon gases. This is the kind of natural gas that we most often use in our kitchens at home. Crude oil is highly flammable and is an excellent source of energy. Its 'sister' hydrocarbon, natural gas, is another source of energy. Oil is called a non-renewable energy source because it cannot be replenished. Petroleum deposits are often found in natural underground reservoirs called oil fields. The oil in these fields can then be extracted by drilling and pumping. C rude oil properties can vary widely depending on where the oil is found and under what conditions it was formed. Its different physical properties are used to design the right kind of refineries, classify the oil (for example, West Texas Intermediate or Oman) and determine an appropriate price for it. The properties of oil include its density, called the API gravity (named after the American Petroleum Institute), sulphur content, nitrogen content, carbon residue and distillation range. Each of these properties is important for different reasons. For example, the sulphur content of crude oil is important because it determines the kind of treatment that it will require at a refinery. The higher the sulphur level, the bigger the effect it will have on the environment—and the more corrosive effect it will have on equipment. API gravity is also important. It is essentially a measure of density. It determines whether a specific type of crude oil has a higher or lower boiling range (or distillate yields), which is important for separating and extracting different parts (or fractions). Different oil-producing areas produce different kinds of crude oil. And depending on its mixture of hydrocarbons, crude oil can vary in colour, composition and consistency. The entire chain is known as the petroleum industry. However, the industry is usually divided into three major components: upstream, midstream and downstream. The upstream industry finds and produces crude oil and natural gas. The upstream is sometimes known as the exploration and production (E&P) sector. The downstream sector commonly refers to the refining of petroleum crude oil and the processing and purifying of raw natural gas, as well as the marketing and distribution of products derived from crude oil and natural gas. The downstream sector reaches consumers through products such as gasoline or petrol, kerosene, jet fuel, diesel oil, heating oil, fuel oils, lubricants, waxes, asphalt, natural gas, and liquefied petroleum gas (LPG) as well as hundreds of petrochemicals. Corrosion is the destructive attack of a material by reaction with its environment and a natural potential hazard associated with oil and gas production and transportation facilities. Almost any aqueous environment can promote corrosion, which occurs under numerous complex conditions in oil and gas production, processing, and pipeline systems [. This process is composed of three elements: an anode, a cathode, and an electrolyte. The anode is the site of the corroding metal, the electrolyte is the corrosive medium that enables the transfer of electrons from the anode to the cathode, and the cathode forms the electrical conductor in the cell that is not consumed in the corrosion process . Crude oil and natural gas can carry various high-impurity products which are inherently corrosive. In the case of oil and gas wells and pipelines, such highly corrosive media are carbon dioxide (CO_2), hydrogen sulfide (H_2S), and free water . Continual extraction of CO_2, H_2S, and free water through oil and gas components can over time make the internal surfaces of these components to suffer from corrosion effects. The lines and the component fittings of the lines would undergo material degradations with the varying conditions of the well due to changes in fluid compositions, souring of wells over the period, and changes in operating conditions of the pressures and temperatures. This material degradation results in the loss of mechanical properties like strength, ductility, impact strength, and so on. This leads to loss of materials, reduction in thickness, and at times ultimate failure. A point will be reached where the component may completely break down and the assembly will need to be replaced while production is stopped. The serious consequences of the corrosion process have become a problem of worldwide significance .Corrosion in the modern society is one of the outstanding challenging problems in the industry. Most industrial designs can never be made without taking into consideration the effect of corrosion on the life span of the equipment. Recent industrial catastrophes have it that many industries have lost several billions of dollars as a result of corrosion. Reports around the world have confirmed that some oil companies had their pipeline ruptured due to corrosion and that oil spillages are experienced which no doubt created environmental pollution; in addition, resources are lost in cleaning up this environmental mess, and finally, large-scale ecological damage resulted from corrosion effects. The possibility of occurrence of corrosion in an industrial plant has been posing a lot of concern to petroleum, chemical, and mechanical engineers and chemists. It is now known that corrosion can have some effects on the chemistry of a chosen process, and the product of corrosion can affect reaction and purity of the reaction products.

Figure 1:- Corrosion of a metal

1.1. 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.

1.2. 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 (height of a smokeless flame) and

hydrofining to reduce sulphur content and to improve odour, colour & burning qualities (char value). The Indian Standard governing the properties of kerosene are IS 1459:1974 (2nd Rev).
Uses of Superior Kerosene Oil (SKO) as follows,

		• As illuminant in various lamps
		• As fuel in cooking stoves/ranges, ovens, blow lamps
		• As cleaning fluid /degreasing components
		• As solvent in paints/printing inks
		• As raw material for the manufacture of paraffin's
		• As a low sulphur fuel in boilers /furnaces

1.3. Aviation Fuel

Aviation fuel is a specialized type of petroleum-based fuel used to power aircraft. It is generally of a higher quality than fuels used in less critical applications, such as heating or road transport, and often contains additives to reduce the risk of icing or explosion due to high temperature, among other properties. Most aviation fuels available for aircraft are kinds of petroleum spirit used in engines with spark plugs (i.e. piston and Wankel rotary engines), or fuel for jet turbine engines, which is also used in diesel aircraft engines.

1.3.1. Avgas

Avgas (aviation gasoline) is used in spark-ignited internal-combustion engines in aircraft. Its formulation is distinct from mogas (motor gasoline) used in cars and many military vehicles such Deuce and 1/2s. Avgas is formulated for stability, safety, and predictable performance under a wide range of environments, and is typically used in aircraft that use reciprocating or Wankel engines.

1.3.2. Jet Fuel

Jet fuel is a clear to straw-colored fuel, based on either an unleaded kerosene (Jet A-1), or a naphtha-kerosene blend (Jet B). It is similar to diesel fuel, and can be used in either compression ignition engines or turbine engines.Jet-A powers modern commercial airliners and is a mix of pure kerosene and burns at temperatures at or above 49 degrees Celsius (120 degrees Fahrenheit). Kerosene-based fuel has a much higher flash point than gasoline-based fuel, meaning that it requires significantly higher temperature to ignite. It is a high-quality fuel; if it fails the purity and other quality tests for use on jet aircraft, it is sold to other ground-based users with less demanding requirements, like railroad engines.

II. COPPER

Copper is a chemical element with symbol Cu (from Latin: cuprum) and atomic number 29. It is a soft, malleable, and ductile metal with very high thermal and electrical conductivity. A freshly exposed surface of pure copper has a reddish-orange color. Copper is used as a conductor of heat and electricity, as a building material, and as a constituent of various metal alloys, such as sterling silver used in jewelry, cupronickel used to make marine hardware and coins, and constantan used in strain gauges and thermocouples for temperature measurement. Copper is one of the few metals that occur in nature in directly usable metallic form as opposed to needing extraction from an ore. This led to very early human use, from c. 8000 BC. It was the first metal to be smelted from its ore, c. 5000 BC, the first metal to be cast into a shape in a mold, c. 4000 BC and the first metal to be purposefully alloyed with another metal, tin, to create bronze, c. 3500 BC.In the Roman era, copper was principally mined on Cyprus, the origin of the name of the metal, from aes cyprium (metal of Cyprus), later corrupted to cuprum, from which the words copper (English), cuivre (French), Koper (Dutch) and Kupfer (German) are all derived. The commonly encountered compounds are copper(II) salts, which often impart blue or green colors to such minerals as azurite, malachite, and turquoise, and have been used widely and historically as pigments. Copper used in buildings, usually for roofing, oxidizes to form a green verdigris (or patina). Copper is sometimes used in decorative art, both in its elemental metal form and in compounds as pigments. Copper compounds are used as bacteriostatic agents, fungicides, and wood preservatives. Copper is essential to all living organisms as a trace dietary mineral because it is a key constituent of the respiratory enzyme complex cytochrome c oxidase. In molluscs and crustaceans, copper is a constituent of the blood pigment hemocyanin, replaced by the iron-complexed hemoglobin in fish and other vertebrates. In humans, copper is found mainly in the liver, muscle, and bone. The adult body contains between 1.4 and 2.1 mg of copper per kilogram of body weight.

Figure 2:- Copper wire

III. COPPER STRIP 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^{0}C 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

Figure 3: Copper strip apparatus

Figure 4:- Copper strip

IV. PROCEDURE

a) Take the oil samples to be tested without filtering.
b) Weigh the strips using for the test.
c) Place the strip (brass or copper) in a clean 250 ml bottle in which 250ml of oil to be added.
d) Place the copper strip standing on its long edge.
e) Lubricate the ground glass stopper with a small amount of sample
f) Place the stopper bottle in the oven at 90^{0}C.
g) Remove the bottle after heating for 24hrs at 90^{0}C.
h) Carefully take the copper strip from flask and wash with acetone.
i) Measure the final weight of the strip.

V. OBESRVATIONS

Si No	Sample	Initial Weight Of Copper Strip(W_1,Gm)	Final Weight Of Copper Strip(W_1,Gm)	Difference Between Initial And Final (W_2-W_1,Gm)	Percentage
1	Atf	1.4	1.9	0.5	35.7
2	Sko	0.9	1.25	0.35	38.8
3.	Diesel	1.4	1.59	0.19	13.5

Table 1:- Inference observed

SFigure 5:- Copper strip in diesel

VI. CONCLUSIONS

The work has been devoted to the study of the comparison of corrosion resistance of copper for samples. Corrosion affects every aspect of exploration and production, from offshore rigs to casing, and reviews the role of corrosion agents such as drilling and production fluids. From the investigation diesel has the least corrosive rate when compared to other fuels.

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