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Research Article

Investigation of Suitable Inhibitors to Reduce Corrosion of Used Metals in Refinery Industries

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Abstract

Corrosion has caused various economic problems in the chemical and petrochemical industries over the years. To prevent the rate of corrosion, as well as to maintain various devices, a series of materials are used as inhibitors. If these materials are used, the lifespan of tools and devices will be increased and economic costs will be reduced. In this study, a new inhibitor that can be used instead of hydrazine was used. This inhibitor is called Levoxin-15 and can be used to prevent corrosion caused by oxygen in steam tanks.

Keywords: Hydrazine; Levoxin-15; Cavity Corrosion; Oxygen Depletion; X-ray; Steel Alloy

Introduction

Corrosion has caused various economic problems in the chemical and petrochemical industries over the years [1-3]. To prevent the rate of corrosion, as well as to maintain various devices, a series of materials are used as inhibitors. If these materials are used, the lifespan of tools and devices will be increased and economic costs will be reduced [4-7]. The corrosion is defined as the destruction or decay of a material by reaction with its environment. Some insist that this definition should be limited to metals, but often a corrosion engineer must consider both metals and non-metals to solve a problem [8-11]. Destruction of paint and rubber by sunlight or chemicals, the corrosion of the wall of a steel furnace, and the corrosion of one solid metal by the melt of another metal are called corrosion. The corrosion can occur quickly or slowly. Railroad tracks usually rust slowly. But, the calling speed is not fast enough to affect their performance over many years. Delhi's famous ferric pillar was built in India about 2000 years ago and is still well on its first day. It is 23 feet high and 2 feet in diameter [12-19].

Types of corrosion

The corrosion can be classified in different ways [20-23]. The basis used in this manuscript is the appearance and shape of the metal [24-27]. In this way, the type of corrosion can be determined simply by observing the corroded metal [28-33]. In most cases, the naked eye is sufficient to detect the type of corrosion [34-41]. But, sometimes magnification (such as a magnifying glass or microscopes with low magnification) will be useful, or valuable information to solve a corrosion problem is often obtained by carefully studying corroded test specimens or equipment or components that have been destroyed [42-49]. In this study, a new inhibitor that can be used instead of hydrazine was used. This inhibitor is called Levoxin-15 and can be used to prevent corrosion caused by oxygen in steam tanks.

Materials and Methods

Description of corrosion process

Various parameters play a role in the occurrence of corrosion problems. Mechanical removal of oxygen can be done by vacuuming

the gases in the tank. Exhaust gases reduce the amount of oxygen to less than 0.5 mg/l to 1 mg/l. Also, by using heater heaters, the oxygen concentration can be reduced to 0.005 mg/l to 0.01 mg/l.

Laboratory equipment

It is a metal box that is located in the pipeline and is in contact with water and oxygen. This box measures the average corrosion rate. Its material is proportional to the material of the steam tank pipeline and its dimensions are proportional to the diameter of the pipeline.

Average corrosion rate = weight of the sample box measured at the beginning of the work multiplied by the specific gravity at the time of contact at the contact surface	(1)
Contact level = sum of 6 levels minus twice the area of the circle	(2)

Table

The device for corrosion measuring is located in the flow path of the passing fluid (which in this study contains water and oxygen) and is eaten based on the coupons used in it and its weight decreases. Because the initial weight of the coupon was measured by a scale. It can be re-weighed over time.

Results and Discussion

The steam tank pipes are typically made of carbon steel or low-alloy steel. The experiments have shown that the rate of ferric corrosion at 310°C is directly related to the acidity of the water. The reaction is performed as follows:

$$Fe + 2NaOH \rightarrow Na_2FeO_2 + H_2 \qquad (3)$$

As shown in reaction 3, the Ferric combines with sodium to form sodium ferrite with the chemical formula Na_2FeO_2. As mentioned above, at pH above 12 and high concentrations of soda, ferric corrosion takes a sharp upward rate and the Fe_3O_4 film is converted to sodium ferrite with the chemical formula Na_2FeO_2. The corrosion effect of soda (sodium carbonate) at high pressures of steam tanks is greater than low pressures. Local corrosion often occurs in steam tanks, and if the acidity level is controlled in the range of 9 to 9.5, it will strongly prevent total corrosion. It also occurs at low acidity levels and is generally visible is in the figure. When the tanks are in standby mode, it is recommended to use Levoxin-15 as a protection against moisture corrosion.

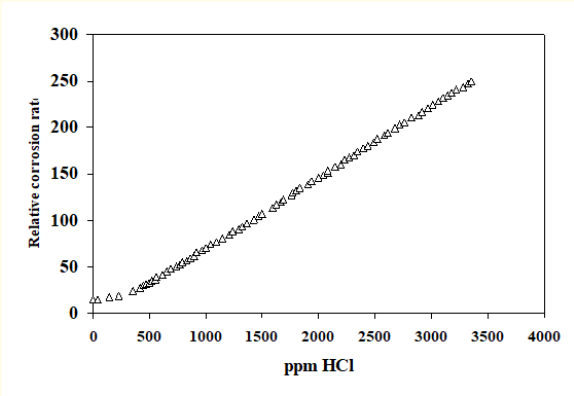

Figure 1: Investigation of relative corrosion in terms of hydrochloric acid concentration.

As shown in figure 1, with increasing the concentration of hydrochloric acid to about 3500 mg/l the relative corrosion rate increases almost, linearly. This increase will be such that at a concentration of 3500 mg/l of hydrochloric acid the corrosion rate will be about 300 times.

Conclusion

Oxygen often removes the protective magnetic layer of Fe_3O_4, thus exacerbating pore corrosion. The precipitate also causes local heating of the pipeline and a large amount of oxygen to attack other parts of the process, including steam tanks. It is also used to delay corrosion. However, this substance is dangerous and toxic and causes dangers to humans, animals and the environment. According to the laboratory results, local corrosion in the tubes of steam tanks as well as general corrosion is delayed by keeping the acidity of water constant between 9 and 9.5.

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