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Effect of green inhibitors in high carbon steel at different temperatures

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Abstract - Corrosion control of metal is of technical, economical, environmental and aesthetical importance. The use of inhibitor is the best way to prevent metal and alloys from corrosion. There is an intensive effort underway to develop new plant origin corrosion inhibitors for metal subjected to various environmental conditions. These efforts are motivated by the desire to replace toxic organic corrosion inhibitors used for mitigation of corrosion of various metals and alloys in solutions. Plants represent a class of interesting source of compounds currently being explored for use in metal corrosion protection in most systems, as possible replacement of toxic synthetic inhibitors. The green corrosion inhibitors are bio degradable, non-toxic, environmentally benign, and low cost, are obtained from renewable resources with minimal health and safety concerns. Investigations of corrosion inhibiting abilities of tannins, alkaloids, organic amino acids and organic dyes of plant origin are of interest. Development of computational modeling backed by wet results would help in understanding the mechanism of inhibition action, their adsorption patterns, inhibitor-metal surface interface and help in the development of designer inhibitor with an understanding of the time required for the release of self-healing inhibitors. The present paper restricts itself mainly to the plant materials as "Green Corrosion Inhibitor". Corrosion is a major problem in this modern industrial era. So the corrosion control of the metal must be technically, economically, eco-friendly and aesthetically equally important. Corrosion Inhibitor creates a barrier between the metals (alloys) and corrosion. These efforts are motivated in order to replace the toxic organic corrosion inhibitors used for the protection of the metals from the corrosion.

Keywords: Green Corrosion Inhibitor, Corrosion Inhibition.

I. INTRODUCTION

Corrosion processes are responsible for numerous losses mainly in the industrial scope. It is clear that the best way to combat it is prevention. Among the various methods to avoid or prevent destruction or degradation of metal surface, the corrosion inhibitor is one of the best know methods of corrosion protection and one of the most useful on the industry. This method is following stand up due to low cost and practice method. Important researches have being conducted with government investment mainly in large areas such as development construction of new pipelines for shale gas and growth in construction. The focus of these researches has being the inhibitors applications in water and concrete for the protection of metals. Corrosion is nature's method whereby metals and alloys return to their unrefined naturally occurring forms as minerals and ores. Corrosion is the deterioration of metals by chemical attack or interaction with its environment. It is a constant and continuous problem, often can not be eliminated completely. Prevention is more practical and achievable than complete elimination. Corrosion is a fast process and accompanied by number of reactions that change the composition and properties of both metal surface and local environment, for example formation of oxides, diffusion of metal cations into the coating matrix, local pH changes and electrode potential. The study of corrosion of mild steel and iron is of tremendous importance as they have wide usage domestically and industrially. Acid solutions are used in the industrial processes, acid cleaning, acid descaling, acid pickling and oil well acidizing, require corrosion inhibitor to prevent the corrosion of metal.

II. CORROSION INHIBITORS

A corrosion inhibitor is a substance which when added in small concentration to an environment, effectively reduces the corrosion rate of a metal exposed to it. Large numbers of organic compounds have been studied and are still being studied to assess their corrosion inhibition potential. However, most of these substances are not only expensive but also posses health and environmental hazards [1] prompting the search for their replacement. Plants have been recognized as sources of naturally occurring compounds that are generally referred to as 'green' compounds, some with rather complex molecular structures

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and having a variety of physical, chemical and biological properties. A number of these compounds are enjoying use in traditional applications such as pharmaceuticals and bio-fuels. Furthermore, there has been a growing trend in the use of natural products as corrosion inhibitors for metals in various corrosive media [2] . The term "green inhibitor" or "eco-friendly inhibitor" refers to the substances that are biocompatibility in nature, environmentally acceptable, readily available and renewable source. Due to bio-degradability, ecofriendliness, low cost and easy availability, the extracts of some common plants based chemicals and their by-products have been tried as inhibitors for metals under different environments [3-7].

III. EXPERIMENTAL ANALYSIS

The specimen is taken of composition of high carbon steel and density of specimen is 7.9 g/cc. Sample cut the substances by the application of force applied on it. Generally cutting is done to make the specimen into desire size by cutter machine. It is an abrasive saw used to cut hard materials, such as metals, tile and concrete.The cutting action is performed by an abrasive disc. A wire saw is a saw that uses a metal wire or cable for cutting.The purpose of grinding step is to remove damage from cutting the specimen and to remove material approaching the area of interest and then weight of sample is taken up to correctly two decimal places . It is an important parameter to measure the length of the sample correctly. Measurement of length of the specimen is done by using scale and diameter can be measure by using vernier calliper.

Element	% composition
C	0.50-0.65
Mn	0.51-0.58
Si	0.125-0.127
S	0.0105
P	0.040

For the comparison of the corrosion rate and weight loss of sample, a specimen is made and it deeps directly into the acidic solution.Loss of weight in % of specimen or samples when dipped in diluteHCl solution. After the preparation of mixtures of three Green Inhibitors, Sample are dipped in the mixture for 144 hours at two different operating temperature and then after a dilute HCl solution is made of 98 ml distilled water and 2 ml conc. HCl. After that samples are dipped in acidic solution for 144 hours.

IV. RESULT AND DISCUSSION

The corrosion rate is the speed at which metals undergo deterioration within a particular environment. Mils penetration per year (MPY) is a unit of measurement equal to one thousandth of an inch. This rate depends on environmental conditions and the condition or type of metal and depends on the following factors.

(i)Weight loss (reduction in weight during reference time) in milligram (W)

(ii) Area (initial surface area) in square inch (A)

(iii) Time (length of reference time) in hours (T)

(iii) Density in gm/cm^3 (D).

Mpy = (534xW)/D.A.T

Specimen	Solution	Duration (in hours)	Corrosion rate (mpy)
High carbon steel	**Conc. Hl +H_2O**	**144**	**0.4995**

The below data explain the corrosion rate of the specimen dipped in various inhibitors at 23°C and 35°C respectively having molar concentration 0.463 for 144 hours.

Sample number	Name of Sample	Temperature(°C)	Corrosion rate(in mpy)
1	Coffee+Honey	23	0.4598
2	Coffee+Honey	35	0.4045
3	Castor Oil+ Guar gum powder	23	0.4064
4	Castor Oil+ Guar gum powder	35	0.2632
5	Aloe vera + pomegranate juice	23	0.3699
6	Aloe vera + pomegranate juice	35	0.3692

V. CONCLUSIONS

The following conclusions: The temperature is high of green inhibitors (mixture of coffee and honey) gives corrosion rate will be less and temperature is less then corrosion rate is high of green inhibitor. Higher temperature mixture of Castor Oil and Guar Gum powder gives the best result among them. Green Inhibitors work more efficiently at higher temperature.

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