

APPLICATION OF WASTE NATURAL MATERIAL FOR CORROSION INHIBITION OF LOW CARBON STEEL IN NaCl SOLUTION

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Abstract - Corrosion of structural mild steel is a serious global issue. As a result, researchers must devote practically all of their effort to reducing steel corrosion difficulties, which leads to economic loss control. Researchers are using a variety of techniques to prevent mild steel corrosion, including the development of high strength, low alloys, corrosion resistant steel, as well as various coatings and inhibitors. In this study, I used an eco-friendly corrosion inhibitor to examine the inhibitory capacity of allium cepa (onion peel) in different solvents against mild steel corrosion in 1.5 M NaCl. Most organic inhibitors are effective because they contain hetero atoms, such as O, S, and N, in their chemical formulas, which are adsorbed onto the steel surface and give corrosion protection in acid solutions, as well as stop the cathodic and anodic reactions at the steel/acid interface. They are, however, costly, dangerous, and necessitate the use of a synthesis expert. Green corrosion inhibitor, on the other hand, is cost-effective, environmentally beneficial, and may be obtained from natural resources. Researchers must devote more time and effort to developing and studying a green inhibitor for usage in NaCl solutions, which showed an inhibitory efficacy of more than 83 percent when using AEOP and roughly 90.142 percent when using an aqueous extract of onion peel. As a result, it is recommended that research be expanded and that a focus be placed on environmentally friendly corrosion inhibitors for a more sustainable society.

Key Words: Corrosion, leads to economic loss control, NaCl, focus be placed on environmentally friendly corrosion inhibitors for a more sustainable society

1. INTRODUCTION

Because metal iron and alloys have good mechanical, thermal, and electrical qualities, which are vital parameters for the selection of any material for industrial and construction purposes, they play a critical role in the development of any nation's infrastructure. Due to their excellent performance cost ratio, steel-made objects are frequently utilized in numerous infrastructure and engineering projects [1]. Corrosion, on the other hand, is a prevalent concern with steel-made things. Corrosion has a significant impact on the appearance and functionality of items [2]. Corrosion is defined as a destructive chemical

assault on metal in partnership with its environment, which might result in a part or framework's capacity being reduced. Because pure metals tend to revert to their previous state of oxides, sulphides, and other compounds, it is sometimes referred to as the reverse process of producing/ extracting metal for ores. Corrosion prevention and maintenance accounted for about 3.5 percent of global GDP. Much of the nation's wealth can be safeguarded and diverted to other sectors, such as high-tech infrastructure development, education, road safety, poverty reduction, and food security. Many industrial mishaps have occurred in the past as a result of corrosion, and many people have died as a result. People have utilized a variety of techniques to address these issues. Waste natural materials (WNM) are stated to be a good economic solution to steel corrosion concerns based on research [4-5]. In diverse media, these WNM create a barrier layer around steel and delay corrosion [6, 7]. The effectiveness of the barrier layer is determined by the molecules that form it. Various investigations claim that aromatic compounds, in combination with inhibitor heteroatoms, are highly efficient against corrosion [8, 9]. As a result, selecting inhibitors based on the features listed in the preceding line can be a first step before evaluating inhibitors for corrosion resistance.

1 Materials Selection:

There are no metal which are harsh toward corrosion in all circumstances, yet through examining and understanding the environmental conditions that actuates corrosion, changes looking like the metal utilized can likewise prompt a generous decrease in the corrosion. The wellbeing information on metal corrosion can be utilized as a component of a blend of regular conditions information to decide the appropriateness of each metal. In explicit cases, the progression of novel mixtures expected to secure against corrosion is as yet under gathering. Furthermore, surface examination additionally assumes a basic part for assurance against corrosion harmful metal.

$$\text{rate of corrosion attack} = \frac{\text{corrosivity of environment}}{\text{corrosion resistance of metal}}$$

2 Design:

Style modifications will assist with moderating corrosion and increment the life span of some current enemy of destructive defensive coatings. In a perfect word, constructions ought to try not to trap residue and water, work with air course, and abstain from breaking. Ensuring that the metal is available for routine repairs would also improve lifespan. Corrosion management starts at the engineering level. If the component is designed for use in an area where it is vulnerable to corrosion, designers should build the component with that in mind. For example, sections exposed to the elements should allow the drainage of water and debris instead of the collection on the floor. In order to minimise crevice corrosion, designers should remove small gaps that cause air or fluid to penetrate and become stagnant.

3 Cathodic Protection:

As examined before galvanic corrosion happens when unique and remarkable metals are blended in with an electrolyte which is destructive in nature. This is an inconsequential issue for metals doused together in seawater, yet it can likewise happen when two extraordinary and various metals are totally soaked in soils which are saturated. Therefore, the galvanic corrosion assaults routinely on convey compartments, military boats, and seen a great deal in oil and gas pipelines. Cathodic Protection works by moving from anodic (dynamic) destinations on the metal surface to cathodic (latent) areas with the utilization of confined current. These restricting current wellsprings of free electrons and neighboring force anodes are obliged by the capability of adjacent cathodes. Mainly two types of cathodic protection. Initial is the introduction of galvanic anodes.

This interaction is known as the placating system, which uses metal as anodes that know about the electrolytic state to give up (dissolve) to ensure the cathode. Cathodic assurance is a demonstrated method to save metals from galvanic consumption hazard. While the metal requires a specific sort of assurance, the accommodating anodes are made of Zn, Al, Mg, the metals with the higher -ve electro-potential. The galvanic design offers an outline of the one of a kind electro-force or trustworthiness of metals and their mixtures.

In a propitiatory air, metallic particles relocate from an anode to a cathode, which makes anode dissolve at an extremely quick rate than is normally the situation. In this way the anode ought to be supplanted consistently. The second method for cathodic security is the most recent crisis safeguard. The adverse terminal of the wellspring of flow is appended to the wire, while the other terminal which is positive terminal is bound to the aide anode, and along these lines finishing the electrical circuit. It isn't care for a galvanic (mollifying) anode gadget, is the aide anode not

surrendered in a motivated current security framework. This technique used to guarantee that pipelines and boat proprietors are protected, and furthermore this strategy requires the elective conveyance of direct current to the electrolyte

4 Inhibitors:

Corrosion inhibitors are synthetic substances which responds to the outer layer of the metal or to natural gases that cause corrosion and afterward meddle with the compound response that causes corrosion. Inhibitors creates a specific sort of corrosion safeguard when they are shaping a thin layer on the outer layer of the metal. Inhibitors can without much of a stretch be work by adsorbing themselves on a specific metal surface and walling it in a defensive film. These synthetic substances can be associated either as a response or as protection safeguard dispersing frameworks.

1.4.5 Coatings:

Coatings, for example, paints are utilized to shield metals from the debasing impacts of ozone harming substances. Debasement of metals can be decreased by use of coatings that are known to be straightforward and financial. Coatings are ordered by the sort of polymer utilized. Typical regular coatings will incorporate the coatings will be collected by the type of polymer utilized. Standard regular coatings will include:

- Coatings viz. Alkyd and epoxy ester that, when air is dried, structures advance cross-association oxidation.
- Two-section covering of urethane.
- Radiation coatings, for example, reparable plastic and epoxy polymer.
- Styrene polymer blend with latex coatings, vinyl, or acrylic
- Water-dissolvable layer
- High-strength coatings
- Fluid covering

Plantings which is plating metallic coatings, might be utilized to oppose rust and may likewise have smooth, adorning covers.

1.5 Corrosion measurement method

Basically there are three types of measuring methods, these are following below.

- ❖ Weight loss measurement

- ❖ Tafel polarization method
- ❖ Electrochemical Impedance Spectroscopy

1.5.1 Weight loss measurement

This is a typical method of technique for detecting corrosion. This method is part of the method in which the sample work piece has been exposed to corrosive atmosphere for a specified period of time and Continuous absence of calculation of weight loss.

The rate of corrosion is estimated by equation mentioned below.

$$\text{Corrosion rate} = K \times$$

$$\frac{\Delta W}{A \times t \times \rho}$$

Where the rate of corrosion millimetres/year.

ΔW = Weight loss of the work piece in gram.

A = Area of the work piece in cm².

t = time period for which the sample has been kept exposure to the rusting environment in hours.

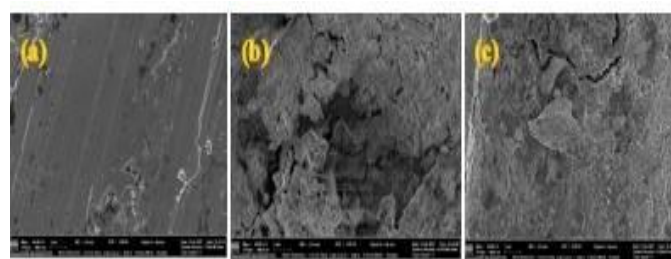
ρ = Density of the work piece in gram/cm³.

K = Constant.

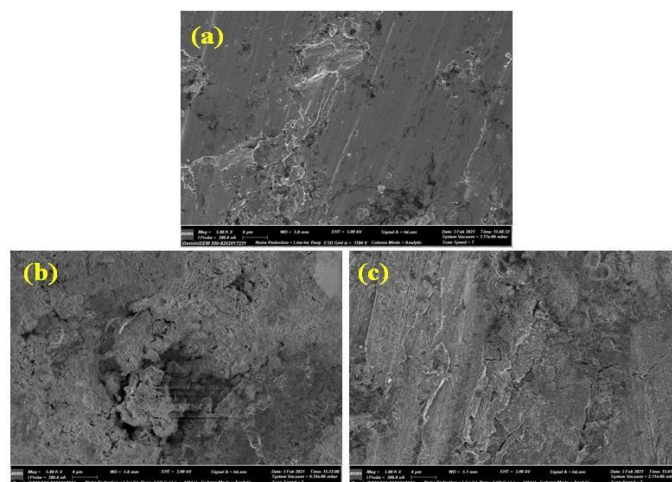
RESULT

Scanning electron microscopy

SEM surface images of LCS with different amounts of AEOP and aqueous extract of onion peel in 1M NaCl. It was self-explanatory after analysis of the images that AEOP and aqueous extract of onion peel was protecting LCS in NaCl. Fig 1.32(a) and 1.33(a) showed surface of prepared LCS specimen, which suggested that some small cracks and stretch marks were generated on the surface due to rough abrading. However, overall the surface was still looking smooth. The 1 M NaCl damaged the surface severely and increased irregularities to very high level along with generation of a big corrosion pit, which was visible in Fig 1.32(b) and 1.33(b). In contrast, AEOP and aqueous extract of onion peel molecules adsorbed on LCS and opposed damage of LCS. The protection was evident in images. However, some cracks on surface could be seen on LCS surface even in presence of AEOP and aqueous extract of onion peel, which suggested that complete protection of LCS in NaCl was not achieved. A schematic of corrosion inhibition mechanism based on SEM.



Showing SEM images of LCS (a) pristine test specimen, (b) in 1 M NaCl and (c) in 1 M NaCl with 1000 mg/L-1 AEOP at room temperature.



Showing SEM images of LCS (a) pristine test specimen, (b) in 1 M NaCl and (c) in 1 M NaCl with 1000 mg L-1 Aqueous extract of onion peel at room temperature.

3. CONCLUSIONS

- ❖ In this work, AEOP and Aqueous extract of onion peel is used to prevent corrosion of LCS in NaCl solution.
- ❖ From result of various technique, it is notice that onion can act as good green corrosion inhibitor.
- ❖ The waste natural material (onion peel) shows maximum protection of 83% efficiency with AEOP and 90.142% with AEOP*, which was a good amount for an inhibitor based on natural material.
- ❖ Based on overall analysis onion peels can be recommended for protection of LCS in NaCl solution.
- ❖ While investigating of polarization bends it was tracked down that both concentrate proceeded as blended sort inhibitor.

4.2 Future scope

- ❑ Onion is made up of different bio molecules. If these bio molecules are studied separately, different results may be obtained.
- ❑ Onion peels are dissolved in chloroform solution to form an extract. When this extract is applied on metallic surface, a coating layer is formed on that surface.
- ❑ Different extract could be brought into use regarding corrosion inhibition in future.

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BIOGRAPHIES



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