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Plant Extracts as Corrosion Inhibitor – Review Article

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A B S T R A C T

In industries where metallic surfaces come into touch with aggressive media, corrosion is a significant problem. Although most synthetic corrosion inhibitors on the market have negative environmental consequences, corrosion inhibitors are frequently utilized to protect metal surfaces. Plant extracts found naturally have shown great promise as a substitute for manufactured inhibitors. An overview of current studies on the use of natural plant extracts as corrosion inhibitors is given in this article. Selected plant extracts are presented along with their corrosion inhibition efficiency and their chemical composition and mode of action.An analysis is also conducted on the impact of different parameters on the corrosion inhibition efficacy of plant extracts, including pH, temperature, and plant concentration. All in all, the findings suggest that natural plant extracts hold great promise as environmentally friendly agents to prevent corrosion on a range of metal surfaces.

Keywords: corrosion, corrosion inhibitor, plant extracts, inhibiting properties.

1. INTRODUCTION

Since natural plant extracts are biodegradable, renewable, and environmentally friendly, their use as corrosion inhibitors has grown in popularity. This article gives an overview of the use of natural plant extracts as corrosion inhibitors, including their mechanisms of action, types, advantages, and disadvantages. Corrosion inhibitors have been used for decades to control and prevent material degradation caused by atmospheric conditions and chemical processes. Additionally it covered the functions of the various chemical components found in plant extracts and how well they work to prevent different kinds of corrosion. Furthermore, new developments—such as micro emulsions, nanocomposites, and hybrid materials—in the application of plant extracts as corrosion inhibitors are discussed. Natural plant extracts have the potential to prevent corrosion, but there are still certain issues that need to be resolved, such as stability, solubility, and affordability. To find new plant extracts and enhance their effectiveness in various environmental settings, more study is needed.

1.1. THYMUS VULGARIS

Thymus vulgaris, also known as common thyme, has been found to have potential as a corrosion inhibitor. In a study published in the Journal of Applied Electrochemistry, it was found that thyme essential oil (TEO) had significant inhibitory effects on the corrosion of mild steel in hydrochloric acid solution. The inhibitory effect of TEO was attributed to its high content of phenolic compounds, particularly thymol and carvacrol, which are known to have strong antioxidant and antimicrobial properties. These compounds work by adsorbing onto the metal surface and forming a protective layer that prevents further corrosion. Overall, the study suggests that thyme essential oil has excellent potential as a natural corrosion inhibitor, particularly in the oil and gas industries where corrosive environments are prevalent.

1.2. AZADIRACHTA INDICA

Azadirachta indica, also known as neem, has been studied as a potential corrosion inhibitor. The inhibitory effect of neem leaves extract was attributed to the presence of various phytochemicals, such as azadirachtin, which can adsorb onto the metal surface and form a protective layer. The phytocompounds in neem leaves extract reduce the corrosion rate of the metal in the acidic media by hindering the dissolution of mild steel in the corrosive solution.

Overall, the study suggests that neem leaves extract has a strong potential as a natural corrosion inhibitor in acidic media. The use of neem as a corrosion inhibitor is advantageous as it is a readily available and low-cost natural product that is non-toxic and biodegradable

1.3. PUNICA PLANT

Punica granatum, commonly known as pomegranate, has been investigated as a potential corrosion inhibitor. The inhibition mechanism of pomegranate peel extract was attributed to the presence of active compounds, such as tannins and flavonoids, which could adsorb onto the surface of mild steel and

form a protective layer. The adsorbed molecules decrease the corrosion rate of mild steel in hydrochloric acid solution by hindering the dissolution of the metal and reducing the corrosive attack.

Overall, the study suggests that pomegranate peel extract has significant potential as a natural corrosion inhibitor for mild steel in hydrochloric acid solution. The use of pomegranate as a corrosion inhibitor is advantageous because it is a low-cost, eco-friendly, and non-toxic natural product.

1.4. GOSSIPIUM HIRSUTUM

Gossipium hirsutum, commonly known as upland cotton, has been studied as a potential corrosion inhibitor. The inhibition mechanism of upland cotton extract was attributed to the presence of active compounds, such as tannins and flavonoids, which could adsorb onto the surface of mild steel and form a protective layer. The adsorbed molecules decrease the corrosion rate of mild steel in hydrochloric acid solution by hindering the dissolution of the metal and reducing the corrosive attack.

Overall, the study suggests that upland cotton extract has significant potential as a natural corrosion inhibitor for mild steel in hydrochloric acid solution.

1.5. ANANAS SATIVUM

The goal of the current investigation was to determine whether an ethanolic extract made from Ananassativum leaves might stop aluminum from corroding in solutions containing hydrochloric acid. The suppression of corrosion was investigated using weight loss and hydrogen evolution techniques. The outcomes showed that the plant extract successfully slowed down the acid-induced corrosion process. Additionally, the more the temperature and extract concentration were raised, the more effective the inhibition was. Adsorption investigations were done to comprehend the mechanism of inhibition. The Langmuir adsorption isotherm was found to be followed by a sativum's adsorption on the aluminum surface, indicating that this is the most suitable adsorption model. In order to get additional understanding of the processes of corrosion and inhibition, several activation parameters were identified.This involved assessing the effects of temperature on the activation energies (Ea), activation enthalpy (ΔHo), and activation entropy (ΔSo).

2. Conclusion

In conclusion, plant extracts can be used to prevent corrosion on a variety of metal surfaces in an efficient and environmentally beneficial manner. It has been discovered that the natural substances in these extracts significantly inhibit corrosion, extending the lifespan and durability of the metal objects. In addition, compared to synthetic substitutes, these inhibitors are less hazardous to the environment and biodegradable. To determine the best plant extracts, maximize their efficacy, and comprehend their mechanisms of action, more research is necessary. Plant extract corrosion inhibitors present an intriguing option for long-term corrosion control in a variety of industrial industries with the right research and application.

Acknowledgements

We would like to express our gratitude for the articles that have been referenced. All the references we took were very clearly understood. We have mentioned all the references below.

Appendix

In this review article we are trying to say that plant extracts can be used as corrosion inhibitor.

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