International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VI Jun 2021- Available at www.ijraset.com

Green Corrosion Inhibitors for Copper in HCl and H_2SO_4 Solution - A Review

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Abstract: ***Corrosion is the deterioration of metal by chemical attack or reaction with its environment. It is a constant and continuous problem, often difficult to eliminate completely. Prevention would be more practical and achievable than complete elimination. Recently, a huge interested for the use of naturally occurring inhibitors extracted from plants have been emerged. Most of the natural products are non-toxic, biodegradable and readily available due to environmental concerns. The inhibitor is chemically adsorbed on the surface of the metal and forms a protective thin film with inhibitor effect or by combination between inhibitor ions and metallic surface. Corrosion of copper and its inhibition was analyzed by weight loss (Gravimetric), effect of temperature and time of immersion methods. Electrochemical methods such as, Potentiodynamic polarization and Electrochemical Impedance Spectra (EIS) were employed. The protective films formed on metal surface have been analyzed by various techniques such as Scanning Electron Microscope (SEM), Energy dispersive X-ray spectrometry (EDS) and. Atomic Force Microscopy (AFM), Fourier transform infrared spectroscopy (FT-IR), UV-Visible spectra, X-ray Diffraction spectroscopy (XRD), Energy Dispersive X-ray Spectroscopy (EDX), electrochemical frequency modulation (EFM) techniques. The results obtained from weight loss and electrochemical techniques were in good agreement. In this review paper, research works produced over the past background on the corrosion of copper in various medium and their corrosion inhibition by using a various green inhibitors were presented.***

Keywords: ***Corrosion, Copper, Green inhibitors, Potentiodynamic Polarization, EIS, SEM.***

I. INTRODUCTION

Corrosion is a natural phenomenon where metals and alloys try to revert to their more stable thermodynamics form due to reaction with the environment that surrounds them. Corrosion is expensive due to loss of materials or their properties, which leads to loss of time during maintenance, the shutting down of systems, and severe failure of some structures, which in some cases may be hazardous and cause injury. Our economy would be drastically changed if there were no corrosion.

Copper with a reddish orange colour is the fifth most usual metal in the earth's crust which is very useful in pure or alloying form. Copper and its alloys are widely used in industries because of some favourable properties such as good corrosion resistance, high electrical and thermal conductivity, mechanical workability and malleability [1]. Copper and its alloys are highly regarded because of their wide application in production of wire, sheets and pipelines in electronic industries, marine industries, power stations, heat exchangers and cooling towers [2] and recently in the manufacture of integrated circuits [3,4]. Copper is known as a noble metal which provides appropriate corrosion resistance in the atmosphere and in some of chemical environments due to the formation of a protective passive (oxide) film or nonconductive layer of corrosion products on its surface [5].

Corrosion of copper can be caused during this chemical treatment after the scale or oxides have been removed, which implies the dissolution of the metal and the consumption of the acid used. This also implies important economic losses for the industrialists [6]. According to widespread use of copper in different industries, the issue of corrosion and corrosion protection of copper has attracted a lot of attention and many studies have been conducted to date on this issue and are still ongoing.

One of the most practical methods for protection against excessive dissolution of metals by corrosion is use of proper inhibitors [7]. Corrosion inhibitors are substances which when added in small concentration to corrosive media decrease or prevent the reaction of the metal with the media [8]. A lot of work has been done to find and develop different types of organic and inorganic inhibitors. However, some of these inhibitors have disadvantages: high cost, toxic to humans, risk of pollution to the environment. In this context, researchers have to search alternatives by focusing on biodegradable, economical, renewable plant products as corrosion inhibitors that do not present any risk to human health and the environment [9].

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