

Corrosion Inhibition of Mild Steel Using Polyaniline and Clove Oil Composites in Acidic Medium

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Abstract

Mild steel (C: 0.16% - 0.18%, Mn: 0.70% - 0.90%, Fe: 98%), also known as plain-carbon steel, is now the most common form of steel because of low price and suitability of its properties for many applications. However, the major challenge is its low resistance to corrosion, especially in acidic environments. Many inorganic inhibitors containing phosphates, chromates and other heavy metals are now being gradually restricted by environmental regulations due to their toxicity and disposal difficulties. Synthetic organic inhibitors are also applied for corrosion inhibition; but it is limited due to high cost of manufacturing and their toxicity to the environment. Therefore, it is desirable to produce eco-friendly, biodegradable green corrosion inhibitors to replace inorganic and synthetic organic inhibitors. Many natural plant extracts have proven efficient as corrosion inhibitors. Recent studies show that the mechanism of the action of green inhibitors depends on the structure of the active constituent of the plant extract. In this research, corrosion inhibition of mild steel under an acidic environment by the composite containing clove oil and the synthetic organic polymer; polyaniline, was studied. The inhibition efficiency was determined by electrochemical impedance measurements and Tafel slope analysis. Furthermore, the effect of concentration of acid and the effect of type of acid on inhibition efficiency was investigated. According to the results obtained, the highest inhibition efficiency was obtained for 0.1 mol L⁻¹ of H₂SO₄ solution. The results also show that the corrosion rates do not differ linearly with concentration of H₂SO₄ and other factors also affect the corrosion rate. Moreover, the results show that the composite layer is a strong corrosion inhibitor of mild steel in H₂SO₄ and HCl media. It also shows that the composite layer does not act as a corrosion inhibitor in a nitric acid medium.

Keywords: *Inhibitors, electrochemical impedance, tafel plot, mild steel*

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