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Studies on Mechanisms of Corrosion Inhibition of Acalypha chamaedrifolia Leaves Extract towards Mild Steel in Acid Medium

Authors : Stephen Eyije Abechi, Casimir Emmanuel Gimba, Zaharaddeen Nasiru Garba, Sani Shamsudeen, David Ebuka Authur

Abstract : The mechanisms of corrosion inhibition of mild steel in acid medium using Acalypha chamaedrifolia leaves extract as potential green inhibitor were investigated. Gravimetric (weight loss) technique was used for the corrosion studies. Mild steel coupons of 2cm × 1cm × 0.27 cm dimensions were exposed for varying durations of between 24 to 120 hours, in 1M HCl medium containing a varying concentrations of the leaves extract (0.25g/L, - 1.25g/L). The results show that corrosion rates dropped from a value of 0.49 mgcm-2hr-1 for the uninhibited medium to a value of 0.15 mgcm-2hr-1 for the inhibited medium of 1M HCl in 0.25 g/l of the extract. Values of corrosion inhibition efficiencies of 70.38-85.11% were observed as the concentration of the inhibitor were increased from 0.25g/L, - 1.25g/L. Corrosion Inhibition was found to increase with increase in immersion time and temperature. The magnitude of the Ea indicates that the interaction between the metal surface and the inhibitor was chemisorptions. The Adsorption process fit into the Langmuir isotherm model with a correlation coefficient of 0.97. Evidence from molecular dynamics model shows that Methyl stearate (Line 5) and (3Z, 13Z)-2-methyloctadeca-3,13-dien-1-ol (line 11) were found to have the highest binding energy of -197.69 ± 3.12 and-194.56 ± 10.04 in kcal/mol respectively. The binding energy of these compounds indicates that they would be a very good corrosion inhibitor for mild steel and other Fe related materials.

Keywords : binding energy, corrosion, inhibitor, Langmuir isotherm, mild steel.
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