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The Inhibitive Study of Aldehyde Derivatives on Low-carbon Steel in 1.0M HCl Solution

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Structured Abstract

Background: Low-carbon steel is commonly used in building infrastructure, but corrosion is a major problem that affects its durability and requires expensive repairs or replacements. To prevent corrosion, organiccorrosion inhibitors, such as aldehyde compounds containing nitrogen, oxygen, and sulphur, are the most effective solution

Methods: The ability of the aldehyde to inhibit corrosion is dependent on how tightly it binds to the surface of the low-carbon steel. The researchers used potentiodynamic polarisation techniques and electrochemical impedance spectroscopy to analyze the corrosion. They also used scanning electron microscopy to examine the surface of the low-carbon steel with and without the presence of amine derivatives to understand its characteristics. The protective effect of the aldehyde derivatives against corrosion was confirmed using various experimental methods, including UV-Visible spectroscopy and Fourier-Transform Infrared Spectroscopy

Results: When compared to an uninhibited solution, an inhibited solution greatly inhibits the corrosion of low-carbon steel, especially at higher concentrations. A 400ppm concentration of the inhibitors formaldehyde and benzaldehyde inhibits 83.52% and 89.43%, respectively. The slope and linear correlation coefficient of the table demonstrate that the Langmuir adsorption isotherm controls the interaction between the inhibitor molecules and the metal surface. SEM micrographs reveal that a solution with inhibitor improves the surface of low-carbon steel when compared to a blank solution. The existence of the aldehyde group is confirmed by FTIR-ATR spectra. In UV-VIS, these experimental findings support the prevention of steel corrosion and the creation of an inhibitor Fe^{2+}/Fe^{3+} combination.

Conclusion: Aldehyde derivatives were successfully examined, and it was discovered that they work well as formaldehyde and benzaldehyde inhibitors. It is advised that future studies examine various temperature ranges to ascertain the ideal circumstances for metal protection. Additionally, utilising varying quantities of hydrochloric acid along with the inhibitor on low-carbon steel in varied circumstances should be considered.

Keywords: Corrosion Inhibitor in low-carbon steel, Aldehyde Derivatives, Benzaldehyde, Formaldehyde, Acid solution

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