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Synthesis and Evaluation of New Isoxazolidine Derivatives of Aldehyde as Corrosion Inhibitors for Mild Steel Corrosion in Acidic and Saline Media

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A new series of isoxazolidine derivatives of aldehyde were synthesized using a nitrone cycloaddition reaction. The corrosion inhibition efficiency of these synthesized compounds on mild steel were determined using a gravimetric method, linear polarization resistance, Tafel extrapolation method, electrochemical impedance spectroscopy, and surface tension in various solutions of the inhibitors in 1 M HCl, 0.5 M H_2SO_4, and CO_2-saturated 0.5 M NaCl (40 °C, 1 atm; 120 °C, 9.9 atm). The *p*-9-[hexahydropyrrolo(1,2-b)isoxazol-2-yl]nonyloxybenzaldehyde performed the best in comparison to the other synthesized inhibitors and two commercial inhibitors. The anodic shift of the E_{corr} values, and the larger reduction of i_{corr} values in the anodic side of the Tafel plots, suggest that the inhibitor molecules acted primarily as anodic inhibitors. The ΔG^{o}_{ads} points towards both physisorption as well as chemisorption of the inhibitors on the metal surface. The inhibitor molecules are best fitted by a Temkin adsorption isotherm in both acids, while the Langmuir adsorption isotherm performed best in a CO_2-saturated saline media. The surface tension confirms that the inhibitor molecules form a film at the metal's surface. The surface coverage data and CMC values demonstrate that the inhibitor molecules undergo adsorption on the metal surface, rather than micellization.

Keywords: Corrosion inhibitors; Potentiodynamic polarization; Electrochemical impedance; Acidic medium; Saline medium.

FULL TEXT