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Exploring the corrosion inhibition effect of two hydrazone derivatives for mild steel corrosion in 1.0 M HCl solution via electrochemical and surface characterization studies

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In the last few decades, scientists have been interested in the deterioration and the corrosion of metals and their alloys in the acidic environment, which is widely used in various industrial applications. To develop new strategies that lead to control and inhibit the corrosion of metals, eco-friendly corrosion inhibitors have received a lot of interest in recent years. In this context, the main goal of the current study is to determine the functionality of two new synthesized hydrazone derivatives as potential corrosion inhibitors for mild steel in acidic HCl solution. To achieve this goal, the corrosion inhibition behavior of (E)-N'-(4-methoxybenzylidene)-2-(6-methoxynaphthalen 2-yl)propanehydrazide (HYD-3) and N'-cyclohexylidene-2-(6-methoxynaphthalen-2-yl)propanehydrazide (HYD-4) on MS was studied by employing electrochemical techniques in combination with surface characterization with the help of SEM-EDS analysis. As a result of these investigations, the two inhibitors exhibited excellent protection efficiency, and the best inhibition effect was shown by HYD-3 (90% at 5×10^{-3} M). Potentiodynamic polarization (PDP) results demonstrated that the two inhibitors are mixed-type inhibitors and that the adsorption isotherm of these molecules responds to the Langmuir model. Further analysis obtained by impedance spectroscopy (EIS) tests showed that the studied inhibitors make a positive impact on the mild steel corrosion process by increasing the polarization resistance with an increase in the concentration of the inhibitor. Another important practical result is that the SEM-EDS

morphological information suggested that the studied compounds form protective films onto the MS surface. Further, the impact of solution temperature and immersion time on HYD-3 performance has been evaluated. Finally, this work demonstrated significantly improved steel corrosion resistance and could pave a way to develop new-tagged inhibitors in this field.

Keywords: Corrosion inhibition; Mild steel; HCl; Hydrazone derivative; EIS; SEM/EDX.

FULL TEXT