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Effect of iodide ion on the inhibition effect of acidic extracts of cinnamon leaves on mild steel corrosion in hydrochloric acid solutions

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The inhibition efficiency of a corrosion inhibitor can be enhanced using additives. These compounds may facilitate the adsorption of corrosion resistant compounds on the metal surface, thereby increasing the inhibition efficiency. The aim of the present study is to investigate the effect of iodide ions on the performance of acidic extracts of cinnamon leaves on the corrosion of mild steel in HCl solutions.

Influence of iodide ions on the corrosion inhibition potential of cinnamon leaves extract prepared in 0.5 mol dm⁻³ HCl solutions was studied using mass loss measurements, electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization technique (Tafel slope analysis). According to mass loss measurements, the addition of 2.5 mmol dm⁻³ KI to 3 g dm⁻³ extract prepared in 0.5 mol dm⁻³ HCl increases the corrosion inhibition efficiency, after 24 h immersion, from 82% to 90%. Change in the concentration of iodide ions in 0.5 mol dm⁻³ HCl solutions in the absence of the extract, however, does not affect the mass loss of mild steel specimens in HCl solutions indicating that the presence of iodide ions alone would have no significant inhibition effect. More sensitive EIS studies conducted using 0.1 g dm⁻³ extract prepared in 0.5 mol dm⁻³ HCl in the frequency range from 100 kHz to 10 mHz leads to a marked increase in polarization resistance from 440 Ω to 830 Ω in the presence of 2.5 mmol dm⁻³ KI. Under the same experimental conditions, the corrosion current density decreases from 288 μA cm⁻² to 164 μA cm⁻², further supporting the synergistic effect of iodide ions. In contrast to mass loss measurements, lower concentrations of the plant extract were used in electrochemical experiments as only a small surface area of mild steel was exposed to the corrosive media.