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Synergistic corrosion inhibition of low carbon steel in HCl and H_2SO_4 media by 5-methyl-3-phenylisoxazole-4-carboxylic acid and iodide ions

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Abstract

The inhibition performance of 5-methyl-3-phenylisoxazole-4-carboxylic acid (MPC) alone and in combination with potassium iodide (KI) for low carbon steel in 1.0 M HCl and H_2SO_4 solutions is studied using weight loss, potentiodynamic polarization (PDP), electrochemical impedance spectroscopy (EIS), linear polarization resistance (LPR), ultraviolet–visible (UV–vis) spectrophotometry, and surface observation methods. The influence of solution temperature on the performance of MPC and MPC + KI is also investigated. Results obtained indicate that the optimum concentration of MPC in 1.0 M

HCl and H_2SO_4 solutions is 500 and 50 mg/L, respectively. The maximum inhibition at the optimum concentrations of MPC in HCl and H_2SO_4 solutions at 25 °C is 46 and 23%, respectively. Addition of 3 mM KI to 500 mg/L MPC in HCl solution and to 50 mg/L MPC in H_2SO_4 solution at 25 °C raised the inhibition efficiency to 86 and 89%, respectively. Inhibition efficiency of MPC and MPC + KI increases with rise in solution temperature with MPC + KI inhibition reaching 88 and 91%, respectively in HCl and H_2SO_4 solutions at 60 °C. Both MPC and MPC + KI acted as a mixed-type corrosion inhibitor according to the PDP results. Surface examination results confirm the effectiveness of MPC + KI mixture in retarding low carbon steel corrosion in 1.0 M HCl and H_2SO_4 solutions. It could be profitable utilizing MPC + KI mixture in the formulation of corrosion inhibitor cocktail for acid cleaning operations.

Keywords:

- 5-Methyl-3-phenylisoxazole-4-carboxylic acid
- acid corrosion
- organic inhibitors
- adsorption
- synergism