Investigation of Synergistic Inhibition Effect of Methyl Violet and Bromide on the Corrosion of Mild Steel in Phosphoric Acid Solution

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The inhibition of mild steel corrosion in 1.0 mol/dm³ phosphoric acid (H₃PO₄) solution by methyl violet without and with bromide ion was studied using weight loss, potentiodynamic polarization and electrochemical impedance spectroscopy methods. The results indicate that combination of methyl violet and bromide ion performs excellent as inhibitor for mild steel corrosion in 1.0 mol/dm³ H₃PO₄ and a stronger synergistic effect exists between methyl violet and bromide ion. The electrochemical results indicate that single methyl violet or combination of bromide ion and methyl violet behaves as mixed type inhibitor with predominated of cathodic effect, and the corrosion reaction is controlled by charge transfer process. It is found that the adsorption process obeys Temkin adsorption isotherm in the absence of bromide ion and Langmuir adsorption isotherm in the presence of bromide ion, respectively. The thermodynamic and kinetic parameters (ΔG_{ads}^0 , ΔH_{ads}^0 , ΔS_{ads}^0 , K_{ads} and E_a) were calculated and discussed. The adsorption of inhibitor molecules on the steel surface is a spontaneous process containing physisorption and chemisorption. The outcomes from weight loss study are well in agreement with those obtained from electrochemical measurements.

Keywords: Corrosion inhibition, Mild steel; Phosphoric acid, Gravimetric methods, Electrochemical techniques, Adsorption, Thermodynamic properties..

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