Electrochemical Studies of the Inhibition Effect of Vitamin B₁ and Bromide Ion on the Carbon Steel Corrosion in Phosphoric Acid Solution

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doi: 10.20964/2019.04.18

Received: 14 December 2018 / Accepted: 14 January 2019 / Published: 10 March 2019

This paper investigates the inhibition effects of Vitamin B₁ without and with bromide ion on carbon steel corrosion in 1.0 mol/L phosphoric acid solution using potentiodynamic polarization and electrochemical impedance spectroscopy techniques. The results indicate that combination of Vitamin B₁ and bromide ion performs excellent as inhibitor for carbon steel corrosion in H₃PO₄ solution and a stronger synergistic effect exists between Vitamin B₁ and bromide ion. The electrochemical studies reveal that single Vitamin B₁ acts as a cathodic type inhibitor, but combination of Vitamin B₁ and bromide ion shows as a mixed-type inhibitor and the corrosion reaction is controlled by charge transfer process. Adsorption of VB₁ on the steel surface obeys Langmuir adsorption isotherm in the absence or presence of bromide ion. 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 and chemical adsorption is absolutely dominant.

Keywords: Corrosion inhibition, Vitamin B₁, Carbon steel, Phosphoric acid, Synergistic inhibition.

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