Corrosion Inhibition of Polydopamine Nanoparticles on Mild Steel in Hydrochloric Acid Solution

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The spherical polydopamine (PDA) nanoparticles with a uniform particle size around 230nm were synthesized successfully by self-polymerization of dopamine hydrochloride in Tris-buffer solution. The inhibitor effects of PDA nanoparticles on mild steel in 1 M HCl were investigated by weight loss, potentiodynamic polarization, electrochemical impedance (EIS), scanning electron microscopy (SEM) and atomic force microscopy (AFM). The results confirmed that PDA nanoparticles adsorbed onto the mild steel surface and efficiently inhibited the corrosion process. The inhibition efficiency of polydopamine inhibitor was up to 86% at a concentration of 40 mol/L, and the adsorption obeyed Langmuir adsorption isotherm. Meanwhile, potentiodynamic polarization studies showed that the corrosion inhibitor was a mixed inhibitor. SEM and AFM further confirmed the formation of a protective film on the mild steel surface.

Keywords: Polydopamine, hydrochloric acid solution, mild steel, adsorption, corrosive inhibitor.

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