1-Phenyl-1H-tetrazole-5-thiol as corrosion inhibitor for Q235 steel in 1 M HCl medium: Combined experimental and theoretical researches

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1- Phenyl-1H-tetrazole-5-thiol (PTZ) as a novel corrosion inhibitor for Q235 steel in 1 M HCl solution was researched via experimental and theoretical ways. In this work, we used a variety of research methods including electrochemical impedance spectroscopy (EIS) measurement, potentiodynamic polarization (PDP) curves, scanning electron microscopy (SEM), quantum chemical calculations and molecular dynamics simulation (MDS). The data of PDP curves manifest that PTZ is a mixed type corrosion inhibitor. The inhibition efficiency is 97.1 % when the PTZ concentration is 5 mM at 298 K. The data of EIS showed that the charge transfer resistance became significantly larger as the concentration of PTZ increased. This indicates that the protective film formed by PTZ on the surface of Q235 steel can effectively inhibit the corrosion of Q235 steel. SEM analysis test results strongly support the electrification data. Besides, the PTZ adsorption on the surface of Q235 is obey Langmuir adsorption. Theoretical calculation experiments further reveal that PTZ can show excellent corrosion inhibition performance.

Keywords: 1-Phenyl-1H-tetrazole-5-thiol; Q235 steel; HCl; corrosion inhibitor; EIS; SEM; Langmuir adsorption

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