

Corrosion Inhibition of Mild Steel in 1 M HCl Solution by Amine Derivatives

Farah Hanis Binti Hamid^a, Nor Zakiah Nor Hashim^{b*}, Hussein Hanibah^b

Structured Abstract

Background: Mild steel (MS) is frequently used in infrastructure construction; however, corrosion-induced unwanted degradation is a significant issue because MS is essential to human civilization and long-term development. Since corrosion has caused destruction and it is very expensive to repair or replace equipment that has been damaged, organic corrosion inhibitors are the best way to control it. Like amine compounds, organic corrosion inhibitors contain heteroatoms, particularly nitrogen, oxygen, and sulphur.

Methods: This study aims to investigate the effectiveness of amine derivatives in avoiding mild steel corrosion in 1.0 M HCl. The corrosion inhibitor that the amine offers depends critically on how tightly it binds to the surface of mild steel. Potentiodynamic polarisation techniques and electrochemical impedance spectroscopy (EIS) were utilised to analyse corrosion. Scanning electron microscopy (SEM) was used to examine the morphological surface of mild steel with and without the presence of amine derivatives to characterise the surface. This anti-corrosion protective feature was proven using a range of experimental approaches, including UV-Visible spectroscopy (UV-Vis) measurement and Fourier-Transform Infrared Spectroscopy (FTIR).

Results: These inhibitors adsorb on the mild steel surface and create a thin layer of protection, according to the results of the potentiodynamic polarisation measurement. The corrosion potential on the Tafel plot has been shifted while the anodic and cathodic current densities have changed due to the inhibitor's presence. Impedance spectroscopy analyses the Nyquist plot to determine how well a circuit can resist the flow of electric current on a non-ideal resistor. The inhibition efficiencies for the amine derivatives inhibitors were ranked as Aniline (85.96%) > n-Butylamine (67.39%) based on potentiodynamic polarization measurement. The presence of fluoro (F) functional group has been found to affect the inhibition performance of amine inhibitors. In addition, the presence of inhibitor show improvement on mild steel surface compared to the untreated sample.

Conclusion: Amine derivatives is an excellent corrosion inhibitor because of the present of heteroatom such as nitrogen that creates a corrosion-protective layer or barrier forms, protecting the surface from corrosive assault.

Keywords: Amine derivatives, mild steel, heteroatom, layer, HCl

*Correspondence: norzakiah@uitm.edu.my

^aSchool of Chemistry and Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia.

^bCentre of Foundation Studies, Universiti Teknologi MARA, Cawangan Selangor, Kampus Dengkil 43800 Dengkil, Selangor, Malaysia.