Junior Science Communications
Faculty of Applied Sciences, UiTM Shah Alam
https://journal.uitm.edu.my/ojs/index.php/JSC

E-ISSN 2637-0689
Vol 36 2024

Colloquium on Applied Sciences - CAS 2023
17-18 July 2023, Faculty of Applied Sciences, UiTM Shah Alam, Malaysia

Corrosion Behavior of Mild Steel in the Presence of Chitosan Grafted Acrylamide-Based Titanium Dioxide (CS-g-PAM/TiO_2) in 1.0 M Hydrochloric Acid (HCl) Solution

Nur 'Ain Abdul Rahman[a], Shadatul Hanom Rashid[a*]

Structured Abstract

Background: Corrosion is the major treat and concern for the mild steel users because it can result in massive metal failures and the loss of parts that manufactured of mild steel. Chitosan-based titanium dioxide hybrid nanocomposites offer a promising corrosion inhibitor strategy for reducing and protecting mild steel corrosion in an aggressive corrosive environment.

Methods: This study synthesized the chitosan (CS) into chitosan-grafted acrylamide (CS-g-PAM). Then it became chitosan-grafted acrylamide-based titanium dioxide (CS-g-PAM/TiO_2) when added titanium isopropoxide. The CS-g-PAM/TiO_2 were characterized with Attenuated Total Reflectance-Fourier- Transform Infrared (ATR-FTIR) and Ultraviolet–Visible (UV-Vis) spectroscopies. The corrosion measurements used were weight loss method and potentiodynamic polarization (PDP) test.

Results: The ATR-FTIR characterization results showed that the CS-g-PAM/TiO_2 was successfully synthesized where the required band, C-N stretching (amine) due to the grafting of polyacrylamide onto the backbone of CS at peak 1088.96 cm^{-1} was found. Apart from that, UV -Vis also reveals a significant absorption peak between chitosan and CS-g-PAM/TiO_2 at 218 nm and 241 nm, which indicated the π-π* transition. The weight loss method demonstrated the highest inhibition efficiency of CS-g-PAM/TiO_2 at 0.00002 M, a better inhibitor than the chitosan alone at 0.00002 M. It was observed that the CS-g-PAM/TiO_2 nanocomposites produced better outcomes than the unmodified chitosan. Next, the potentiodynamic polarization curve reveals the lowest corrosion rate (0.187mm/year) at the maximum concentration of CS-g-PAM/TiO_2, 0.00002 M. Thus, concluding that the higher the concentration of CS-g-PAM/TiO_2, the higher the inhibition efficiency thus reducing the corrosion rate.

Conclusion: The chitosan-grafted acrylamide-based-titanium dioxide was found to be an alternative inhibitor potential for corrosion protection of mild steel in hydrochloric acid solution. From the findings, chitosan-grafted acrylamide-based titanium dioxide enhanced corrosion protection performance compared to chitosan alone.

Keywords: CS-g-PAM/TiO_2, Chitosan, Inhibitor, Potentiodynamic Polarization

*Correspondence: shadatulhanom@uitm.edu.my

[a]School of Chemistry and Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia