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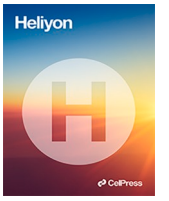

Research article

Palmitic acid-based amide as a corrosion inhibitor for mild steel in 1M HCl

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ABSTRACT

Due to growing environmental concerns and regulations limiting the use of harmful and toxic synthetic corrosion inhibitors, there is a high demand for sustainable corrosion inhibitors. In this study, a green and rapid technique was used to synthesize amide *N*-(4-aminobutyl)palmitamide (BAPA) which yielded 91.17% of the product within 2 min, compared to a low yield of 75–80% and a very long 8–10 h reaction time with the conventional thermal condensation method. The chemical structure of BAPA was analyzed by FT-IR, 1HNMR and 13CNMR spectra, as well as CHNS elemental analysis. When applied to mild steel exposed to 1 M HCl, BAPA delayed and reduced corrosion by adsorbing to the steel surface to form a protective layer. The inhibition efficiency increased with increasing amide concentration, and maximal inhibition of 91.5% was observed at 0.5 mM BAPA. The adsorption of BAPA on mild steel in an acidic solution was studied and inhibition performance was correlated with the calculated adsorption-free energy ΔGads, indicating good agreement between the experimental and adsorption findings. Surface morphology of untreated and treated mild steel coupons was evaluated by SEM, and based on density functional theory (DFT) computations and atomic charges analysis, a stronger interaction was observed between BAPA and mild steel surface leading to the formation of a compact protective film on the metallic surface. This protective film is attributed to the presence of nitrogen atoms and carbonyl group in the chemical structure of BAPA.

1. Introduction

In general, synthetic organic compounds that contain heteroatoms and/or pi electrons, are soluble in water, effective at low doses, relatively inexpensive, and have excellent inhibitory abilities are suitable as metal corrosion inhibitors. However, their use is limited due to issues of toxicity. Therefore, current research is focused on developing affordable, non-toxic, and easily synthesized corrosion

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