

Accepted Manuscript

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PII: S0167-7322(17)31779-8
DOI: doi: [10.1016/j.molliq.2017.05.130](https://doi.org/10.1016/j.molliq.2017.05.130)
Reference: MOLLIQ 7422
To appear in: *Journal of Molecular Liquids*
Received date: 25 April 2017
Revised date: ####REVISEDDATE###
Accepted date: 29 May 2017

Please cite this article as: Raman Kumar, Rashi Chopra, Gurmeet Singh , Electrochemical, morphological and theoretical insights of a new environmentally benign organic inhibitor for mild steel corrosion in acidic media, *Journal of Molecular Liquids* (2017), doi: [10.1016/j.molliq.2017.05.130](https://doi.org/10.1016/j.molliq.2017.05.130)

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Electrochemical, morphological and theoretical insights of a new environmentally benign organic inhibitor for mild steel corrosion in acidic media

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Abstract

In this work a new and environmentally benign corrosion inhibitor namely “4-(2-amino-4,5-dimethylphenyl)imino)methyl)benzaldehyde (APMB)” was synthesized for protection of mild steel (MS) in 0.5 M sulphuric acid media. The synthesis was carried out at room temperature with cost effective reagents and solvents. Electrochemical procedures show that APMB can protect mild steel; with maximum corrosion protection efficiency up to 98.35 % at a concentration of 1 mM and even at the lowest concentration (0.001 mM) the protection efficiency was quite significant. The synthesized compound acts as mixed type inhibitor. ATR-FTIR, SEM-EDS and AFM characterization specifies that the corrosion was prevented by formation of a protective layer of APMB on metal sample. Temperature kinetics study confirms that the adsorption of APMB on MS was following Langmuir’s isotherm for monolayer adsorption. Several other thermodynamic adsorption and activation parameters were evaluated to supplement the above findings. In addition, the mechanism of inhibition was also studied via DFT (Density functional theory) treatment of APMB molecule.

Keywords: Corrosion inhibition, Schiff’s base, Density Functional Theory, Attenuated Total Reflectance, Scanning Electron Microscopy-Energy Dispersive X-Ray Spectroscopy and Atomic Force Microscopy.

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