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Iron corrosion inhibition using self-assembled layer of Schiff base ligand in saline and acidic media

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Corrosion is an inevitable phenomenon and a naturally occurring process that can be defined as the deterioration of a metal surface through chemical or electrochemical interaction with its surrounding environment. Corrosion is an immense problem that significantly affects financial costs, environmental issues, and public safety. Numerous industries, including the automotive, construction, electronic, and other manufacturing sectors are used iron due to its low cost and excellent mechanical properties. Red brown iron oxide is formed, when iron is exposed to oxygen in the presence of moisture. Thus, corrosion prevention methods are very important. In this study, the Schiff base ligand was investigated as a corrosion inhibitor for iron surfaces in saline and acidic media as the main objective. Schiff base ligand was synthesized using salicylaldehyde and 4-chloroaniline. Synthesized Schiff base ligand was characterized using Thin Layer Chromatography (TLC), Fourier Transform Infrared Spectroscopy (FTIR) and UV-visible Spectroscopy. The FTIR spectrum displayed a significant peak at 1608 cm^{-1}, indicating the C=N stretching vibration. The absence of the C=O peak in the salicylaldehyde and the N-H peak in the 4-chloroaniline, coupled with the appearance of a new band representing C=N, confirms the formation of the Schiff base ligand. Self-assembled layer is used as the coatings that prevent corrosion. Schiff base ligand form self-assembled layer on the iron surface. Self-assembled layer was examined using contact angle measurement and it showed 91^{o} contact angle. This result suggests generation of hydrophobic film. Corrosion inhibition properties of Schiff base ligand on the iron substrate was studied through weight loss measurement, scanning electron microscope images (SEM) and ferroxyl indicator test. SEM analyses show, the blank iron substrate exhibited rough, corroded and irregular surface than coated iron substrates with Schiff base ligand after saline and acidic corrosion. The potassium ferricyanide was used for ferroxyl indicator test which can form a prussian blue complex in the presence of Fe^{2+} ions at the anode. No blue coloration was observed in the coated region with Schiff base ligand in both saline and acidic media. The mean corrosion rate and inhibition efficiency were calculated using weight loss measurement. The iron substrate coated with Schiff base ligand shows 51.68 % of corrosion inhibition efficiency in saline media and 49.89 % of corrosion inhibition efficiency in acidic media. In both acidic and saline media, blank iron surface shows the highest mean corrosion rate than coated iron substrate with Schiff base ligand. Therefore, Schiff base ligand acts as corrosion inhibitor in both acidic and saline media by making covalent bonds using electrons, and they chemisorb onto the iron surface. The developed corrosion inhibitor can be used for applications such as manufacturing anti-corrosion paint.

Keywords: Corrosion inhibition, Self-assembled, Iron corrosion, Schiff base

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