

Corrosion inhibition of iron in saline medium by schiff base derived Co(II) and Zn(II) complexes as self-assembled protective layers

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Iron corrodes through electrochemical reactions with oxygen and moisture, forming rust (hydrated ferric oxide), so protective coatings are essential to maintain the structural integrity. This study reports an experimental assessment of newly synthesized Schiff base metal complexes of Co(II) and Zn(II) as corrosion inhibitors for iron in saline medium. The metal ions were selected due to their distinct *d*-orbital configurations (Co²⁺; *d*⁷ and Zn²⁺; *d*¹⁰), influencing ligand-to-metal charge transfer (LMCT) and adsorption behavior, as well as non-toxicity. Structural characterization was performed using FTIR and UV-visible and NMR spectroscopy. The free ligand shows characteristic C=N stretch at 1612 cm⁻¹ indicated imine functional group, which shifted to 1603 cm⁻¹ (Co-complex) and 1602 cm⁻¹ (Zn-complex) upon complexation. Furthermore, analysis of UV spectra revealed that coordination with Zn(II) and Co(II) ions led to slight bathochromic shifts in the absorption maxima to 233 nm and 235 nm, indicating LMCT or *d-d* electronic transitions. Elemental (CHN) analysis further verified the Co(II) and Zn(II) complexes. Surface wettability studies using contact angle measurements revealed the development of self-assembled protective layers on the iron surface, indicating effective adsorption of the complexes. The Zn(II) complex achieved the highest contact angle of 77°, indicating the highest hydrophobicity

compared to the Co(II) complex and bare substrate. Corrosion inhibition was evaluated using ferroxyl test, SEM, weight-loss, and EIS techniques. Ferroxyl test confirmed silane-coated areas resist corrosion better than uncoated regions. According to the impedance results, Co(II) and Zn(II) coatings show higher charge transfer resistance than ligand-only and bare substrate in 3.5% NaCl solution. The results showed that the Co(II) and Zn(II) complexes provide enhanced corrosion protection compared to the ligand alone and uncoated iron. Overall, the results confirm that the both metal complexes, particularly Zn(II), effectively achieve the objective of enhancing corrosion protection for iron in saline media.

Keywords:

Corrosion, Corrosion inhibitors, Iron corrosion, Schiff base metal complexes

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