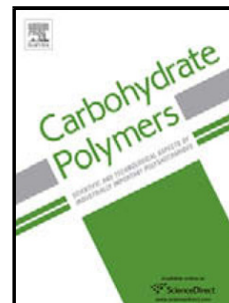


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## Gum Arabic-silver nanoparticles composite as a green anticorrosive formulation for steel corrosion in strong acid media

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### Highlights

- Green corrosion inhibitor of GA,AgNPs, and honey has been formulated for steel in strong acid media
- Characterization has been done using FTIR, UV-vis, EDAX, and SEM
- Anticorrosion study has been achieved using EIS, EFM, DEIS, and TP techniques
- GA-AgNPs is an effective anticorrosive agent for steel in strong acid media
- GA-AgNPs acts as mixed type inhibitor in H<sub>2</sub>SO<sub>4</sub> but as anodic type in HCl solutions
- Adsorption of GA,AgNPs is verify using SEM, EDAX, AFM, & XPS techniques

### Abstract

A green anticorrosive composite (GA-AgNPs) has been formulated for steel in 15% HCl and 15% H<sub>2</sub>SO<sub>4</sub> media. Characterization of GA-AgNPs is achieved via FTIR, UV-vis, EDAX, and SEM. Gravimetric, electrochemical (EIS, EFM, DEIS, & TP), and surface assessment (SEM, EDAX, AFM, & XPS) techniques have been deployed in the anticorrosion studies. Results from all applied methods portray GA-AgNPs as effective anticorrosive agent. Inhibition is by adsorption mechanism and follows Langmuir isotherm. GA-AgNPs acts as mixed type inhibitor in 15% H<sub>2</sub>SO<sub>4</sub> solution but as anodic type in 15% HCl solution. Results from surface techniques confirm adsorption of GA-AgNPs molecules on specimen surface. Oxides, hydroxides, carbonates, and sulphates (H<sub>2</sub>SO<sub>4</sub> medium) or chlorides (HCl medium) are the corrosion products in the free corrodent according to XPS results. In the presence of composite, both ionic and neutral forms of GA-AgNPS are adsorbed. AgNPs are present on the surface in the form: Ag<sup>0</sup>, Ag<sub>2</sub>O, and AgO.

**Keywords:** Acid corrosion; Inhibition; Natural polymer; Nanocomposite; Green inhibitor; Adsorption

## 1. INTRODUCTION

Aggressive acid solutions come in direct contact with metals during industrial exercises like metal scale removal and cleaning, acid descaling, oil well acidizing, etc. These industrial exercises usually cause metals corrosion. It is customary that metals corrosion inhibitors be

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