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Polysaccharide from *Tamarindus indica* as a promising green inhibitor for low carbon steel corrosion in 1 M HCl

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A natural polysaccharide was isolated from *Tamarindus indica* seeds, the tamarind seed polysaccharide (TSP). The performance of TSP as corrosion inhibitor for low carbon steel in 1 M HCl has been evaluated through various experimental methods. The initial screening by gravimetric analysis revealed the good inhibition efficiency by the inhibitor reaching a maximum of 90.10% at 60°C. Thermodynamic and kinetic parameters were instrumental in understanding the process of adsorption. The adsorption of TSP obeys Langmuir adsorption isotherm exhibiting a comprehensive adsorption on low carbon steel surface. Electrochemical impedance measurements suggest the protection of low carbon steel surface by the adsorbed TSP film. Polarization studies inform us that the inhibition of low carbon steel by TSP is of mixed type. The improvement in surface morphology was assured by scanning electron microscopy (SEM) and atomic force microscopy (AFM). UV-Vis spectroscopy assured the formation of TSP-Fe²⁺ complex. The adsorbed TSP film on the low carbon steel surface is characterized using FTIR spectroscopy. To derive a better perception of the corrosion process at molecular level, the important factors relative to the adsorption behavior of the TSP are addressed using theoretical calculations. Application of TSP as a green polymer in corrosion inhibition is of utmost interest, as, not only it is biodegradable, nontoxic and biocompatible in nature, but, being a green polymer also aids in recycling of global carbon.

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