SYNTHETIC AND NATURAL ORGANIC INHIBITORS FOR METAL CORROSION: PHYSICOCHEMICAL, ELECTROCHEMICAL, MORPHOLOGICAL AND QUANTUM MECHANICAL INVESTIGATIONS

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Synthetic and natural organic inhibitors for metal corrosion: physicochemical, electrochemical, morphological and quantum mechanical investigations

ABSTRACT

In recent years, the regulation of metal corrosion has been a great interest in the field of scientific research. The best and favourable method to reduce metal degradation is the usage of corrosion inhibitors. Natural products can be used as green corrosion inhibitors due to their eco-friendliness, low cost and availability. In the present work, plant extracts have been used as green corrosion inhibitors for mild steel in acid media.

Microbial induced corrosion (MIC) is the destruction of a metal by the activity of living organisms either directly by enhancing the electrochemical reactions or indirectly because of their metabolic products. Natural products have some antimicrobial effects in situ. So, in this work synthetic inhibitors are used as MIC inhibitors. Schiff bases good example for synthetic organic compounds with potent corrosion inhibition activities.

The thesis deals with physicochemical, electrochemical, morphological and quantum mechanical investigations on some selected natural corrosion inhibitors for mild steel in acid medium and on some synthetic inhibitors for microbial induced corrosion of mild steel in marine environment. The thesis spreads into nine main chapters. Chapter 1 deals with the introduction about corrosion, especially microbiologically influenced corrosion, mechanism of corrosion and corrosion control methods. This chapter also deals with the detailed literature, aim and scope of the work. Chapter 2 provides an account of the materials, methods and instruments used in this investigation. Chapter 3 brings out the corrosion inhibitory activity of *lxora coccinea* extract on mild steel in 1M HCl and 0.5M H_2SO_4 using various corrosion monitoring methods. The study revealed the excellent inhibition efficiency of the extract. Theoretical calculations and statistical analysis have also been performed. Chapter 4 depicts the corrosion inhibition studies of *Croton persimilis* extract on mild steel. Chapter 5 contains the results of the application of *Tinospora cordifolia* extract as a corrosion inhibitor for mild steel in 1M HCl and 0.5M H_2SO_4. The surface morphological studies have been performed using AFM to ascertain the adsorption performance of the inhibitor on the mild steel. Chapter 6 illustrates the similar studies on mild steel under the same conditions using *Garcinia cambogia* extract. Chapter 7 deals with inhibitive action of *Clerodendrum infortunatum* leaf and root extracts (CILE and CIRE) on mild steel in 1 M HCl and 0.5 M H_2SO_4 using various techniques. Chapter 8 is devoted to anti-corrosion studies of *Dioscorea bulbifera* extract. The final chapter includes isolation and identification of bacterium from sea water and microbial induced corrosion studies using synthetic organic inhibitors derived from pyridine carbonyl compounds.