

SUMMARY

This thesis incorporated the preparation, phytochemical screening, and FTIR spectroscopy of seven natural plant extracts as corrosion inhibitors for mild steel in acid media. *Ixora coccinea* extract (ICE), *Croton persimilis* extract (CPE), *Tinospora cordifolia* extract (TCE), *Garcinia cambogia* extract (GCE), *Clerodendrum infortunatum* extract (CILE and CIRE) and *Dioscorea bulbifera* extract (DBE) were the plant extracts applied as green corrosion inhibitors. Phytochemical screening of all the extracts showed the same results as in the literature review. Characterization of the extracts was carried out using FTIR spectroscopy.

Corrosion inhibition efficiency of these seven extracts was screened on mild steel in 1.0 M HCl and 0.5 M H₂SO₄ using weight loss measurements and electrochemical studies such as electrochemical impedance spectroscopy, potentiodynamic polarization and electrochemical noise measurements. Evaluation of the adsorption phenomenon of the extracts on mild steel surface was carried out using various adsorption isotherms to derive the inhibition mechanism. All the inhibitors showed both physisorption and chemisorption during the adsorption process. The metal binding ability of these extracts was proved by UV-Visible spectroscopy. Surface morphological studies like SEM and AFM were performed to confirm the adsorption behaviour of extracts. Temperature studies revealed that inhibition potential reduces at higher temperatures due to the desorption of the adsorbed layer for all the extracts. Potentiodynamic polarization studies showed that all the inhibitors are mixed-type inhibitors. It has been found that, generally, inhibition efficiency in the HCl medium was more predominant than H₂SO₄ medium, except in the case of CPE.

Scanning electron microscopy and atomic force microscopy were recorded to establish the protective nature of plant extracts on the mild steel surface. All the metal

surfaces exposed in the inhibitor solution were found to be more fine and smooth than in blank solution. Quantum mechanical calculations of major components of all the extracts were also done to predict theoretical corrosion inhibition efficiency. Statistical analysis was performed to optimize factors like temperature, inhibitor concentration and acid concentration on inhibition efficiency using Response surface methodology and BBD/CCD design. Regression model could describe the interdependence between factors on the inhibition efficiency and the results obtained from experiments in good agreement.

Four synthetic Schiff base inhibitors derived from pyridine carbonyl compounds such as N-hydroxy-1-(pyridin-2-yl) methanimine (NHP2M), N-hydroxy-1-(pyridin-3-yl) methanimine (NHP3M), (E)-2-(1-(2-phenylhydrazono) ethyl)pyridine (2PHEP) and (E)-2-(1-triazylidineethyl) pyridine (2TAEP) were applied as microbial induced corrosion (MIC) inhibitors for mild steel in marine environment. Isolation and identification of the resulting culture showed the possibility of mixed culture of related bacteria in the isolate from original seawater. MIC inhibition studies such as weight loss measurements and electrochemical studies such as electrochemical impedance spectroscopy and potentiodynamic polarization studies were performed. NHP3M was found to be more efficient than all other inhibitors. The decreasing order of inhibition efficiency of Schiff base inhibitor systems is as follows: NHP3M > 2PHEP > NHP2M > 2TAEP. Potentiodynamic polarization studies revealed that Schiff base inhibitors were acted as mixed-type inhibitors. Mechanism of MIC inhibition was established using surface analysis like XRD, FTIR spectroscopy and microscopic surface analysis, *in vitro* antibacterial effects of inhibitors and UV-Visible spectroscopy. The proposed mechanism of inhibition was described as Schiff base inhibitors disturbing biofilm formation by adsorbing on the metal surface, not by killing microorganisms.