## List of Figures

Figure 1.1 Showing various terms of electrochemical impedance spectroscopy (Page No. 22)

Figure 1.2 Showing various terms of Tafel Polarization curves	(Page No. 23)
Figure 2.1 Perkin Elmer Lambda 25 Uv-vis Spectrometer	(Page No. 44)
Figure 2.2 Thermo Scientific, Nicolet 6700, FTIR Spectrometer	(Page No. 44)
Figure 2.3 HPLC Instrument (METROHM) for chromatographic analysis	(Page No. 45)
Figure 2.4 Schematic illustration of weight loss measurements technique	(Page No. 47)
Figure 2.5 CH Instruments (CHI7041C) for electrochemical measurements	(Page No. 49)
Figure2.6 Scanning Electron Microscope, SUPRA 40, Carl Zeiss, Germany	y (Page No. 50)
Figure 2.7 Atomic Force Microscope, model Pro 47, NT-MDT, Russia	(Page No. 51)
Figure 3.1 FT-IR spectrum of aqueous leaf extract of Argemone Mexicana	(Page No. 53)
Figure 3.2 UV-Vis Spectrum of Argemone Mexicana aqueous leaf extract	(Page No. 54)
Figure 3.3 HPLC Chromatograph of AM extract	(Page No. 54)
Figure 3.4 Corrosion rate and inhibition efficiency at various concentrations of AMLE in	
0.5 M sulfuric acid at 26±1° C for 5h	(Page No. 56)
Figure 3.5 Langmuir isotherm fitting for mild steel in (a) 1 M HCl and (b) H <sub>2</sub> SO <sub>4</sub>	
solutions	(Page No. 57)
Figure 3.6 Showing UV-Vis spectra of pure extract and mild steel in HCl	and H2SO4 in
presence of maximum extract concentration	(Page No. 58)
Figure 3.7 Showing effect of immersion time on inhibition potential	of the AMLE
(Page No. 59)	

Figure 3.8 Corrosion rates and inhibition efficiencies obtained for mild steel in HCl andH2SO4 alone and in presence of the extracts (maximum concentration) by weight lossmethod at room temperature(Page No. 60)

Figure 3.9 Arrhenius plot for mild steel in (a) 1 M HCl and (b) 0.5 M H2SO4 withdifferent concentrations of AMLE(Page No. 61)

 Figure 3.10 Transition state plot for mild steel in 1 M HCl with different concentrations

 of AMLE
 (Page No. 63)

Figure 3.11 Tafel plot of mild steel in 1M HCl with different concentrations of AMLE in1M HCl solution(Page No. 65)

Figure 3.12 Polarization curve plot for mild steel in 0.5 M sulfuric acid with differentconcentrations of AMLE(Page No. 66)

Figure 3.13 Showing (a) Nyquist plot and (b) bode plot for mild steel in 1M HCl in<br/>absence and presence of AMLE(Page No. 69)

Figure 3.14 Showing (a) Nyquist plot and (b) bode plot for mild steel in 0.5 M H2SO4 inabsence and presence of AMLE(Page No. 69)

**Figure 3.15** Fitting curves showing relation between simulated and experimental data (Page No. 71)

Figure 3.16 SEM images of (a) mild steel (b) corroded steel in HCl and (c) inhibited mild steel (Page No. 72)

Figure 3.17 SEM images of (a) mild steel (b) corroded steel in  $H_2SO_4$  and (c) inhibitedmild steel(Page No. 73)

Figure 3.18 3D AFM images of (a) mild steel, (b) HCl corroded steel, (c) inhibited steel,(d) H2SO4 corroded surface and (e) inhibited steel in sulfuric acid(Page No. 75)

Figure 3.19 Chemical structures of (a) Flavonoids, (b) Tannins and (c) amino acids (Page No. 76)

**Figure 4.1** HPLC Chromatograph of aqueous extract of Chlorophytum Borivilianum root (Page No. 78)

Figure 4.2 FTIR spectrum of aqueous root extract of *Chlorophytum Borivilianum* (Page No. 79)

Figure 4.3 Uv-visible spectra of a) the pure extract, b) 500 mg  $L^{-1}$  of extract in 1 M HClsolution and c) 500 mg  $L^{-1}$  extract in 0.5 M H<sub>2</sub>SO<sub>4</sub> solution(Page No. 80)

**Figure 4.4** Showing a) Corrosion rate and b) Inhibition efficiency obtained at different concentrations of CBRE in 1 M HCl and  $0.5 \text{ M H}_2\text{SO}_4$  at  $26\pm1^\circ$  C for 5h (Page No. 82)

Figure 4.5 Langmuir isotherm fitting for mild steel in 1 M HCl and 0.5 M  $H_2SO_4$ containing different concentrations of inhibitor(Page No. 83)

**Figure 4.6** Showing effect of immersion time on inhibition potential (500 mg  $L^{-1}$ ) of the extract in 1 M HCl and 0.5 M H<sub>2</sub>SO<sub>4</sub> at 26±1° C for 120 Hours (Page No. 84)

**Figure 4.7** Inhibition efficiencies and corrosion rates for 500 mg  $L^{-1}$  CBRE in different concentration of (a) HCl (b) H<sub>2</sub>SO<sub>4</sub> solutions and in blank acid solutions (Page No. 86)

Figure 4.8 Arrhenius plot for mild steel in (a) 1 M HCl and (b) 0.5 M H2SO4 withdifferent concentrations of CBRE(Page No. 87)

Figure 4.9 Transition state plots for mild steel in (a) 1 M HCl and (b) 0.5 M H2SO4 withdifferent concentrations of CBRE(Page No. 88)

Figure 4.10 Tafel curve plot for mild steel in a) 1M HCl and b) 0.5 M H2SO4 with differentconcentrations of inhibitor at Room Temperature(Page No. 90)

**Figure 4.11** Showing Nyquist plots for mild steel in (a) 1 M HCl , (b) 0.5 M H<sub>2</sub>SO<sub>4</sub> and bode plots in (c) 1 M HCl, (d) 0.5 M H<sub>2</sub>SO<sub>4</sub> at different concentrations of CBRE at room temperature. e) Equivalent electrochemical circuit for fitting of experimental results (Page No. 94)

**Figure 4.12.** SEM images showing surface morphology of (a) mild steel test sample before immersion, (b) after immersion in 1 M HCl, (c) in presence of inhibitor (500 mg

 $L^{-1}$ ) in 1 M HCl, (d) after corrosion in 0.5 M H<sub>2</sub>SO<sub>4</sub> (e) in presence of inhibitor (500 mg  $L^{-1}$ ) in 0.5 M H<sub>2</sub>SO<sub>4</sub> (Page No. 97)

**Figure 4.13** 3D AFM images showing morphology of (a) mild steel sample, (b) corroded surface in 1 M HCl, (c) inhibited surface (500 mg  $L^{-1}$ ) in 1 M HCl, (d) corroded in 0.5 M H<sub>2</sub>SO<sub>4</sub> and (e) inhibited (500 mg  $L^{-1}$ ) in 0.5 M H<sub>2</sub>SO<sub>4</sub> (Page No. 98)

Figure 4.14 Showing general chemical structure of Saponins (Page No. 99)

Figure 5.1 HPLC graphs of (a) RMPPE, (b) RIMPPE and (c) ORIMPPE (Page No. 102)

Figure 5.2 UV-visible spectra of (a) banana peel extracts and (b). Zoom in view of the spectra. (Page No. 103)

Figure 5.3 Showing Band gap of banana peel extracts (Page No. 104)

**Figure 5.4** FTIR spectra of banana peel extracts at different maturity stages (Page No. 105)

**Figure 5.5** Corrosion rates and Inhibition efficiencies obtained by weight loss method in 1 M HCl at different concentrations of banana peel extracts at  $26 \pm 1^{\circ}$ C (Page No. 107)

**Figure 5.6** UV-Visible spectra of solutions containing washing of mild steel immersed in (a) 1 M HCl and (b) 0.5 M H<sub>2</sub>SO<sub>4</sub> in presence of inhibitors (300 mg  $L^{-1}$ ) (Page No. 109)

Figure 5.7 Langmuir isotherm fitting for mild steel in (a) 1 M HCl and (b) 0.5 M H2SO4at room temperature(Page No. 110)

**Figure 5.8** Showing effect of immersion time on inhibition potential (300 mg  $L^{-1}$ ) of the extracts in (a) 1 M HCl and (b) 0.5 M H<sub>2</sub>SO<sub>4</sub> at room temperature for 120 Hours (Page No. 111)

Figure 5.9 Showing the effect of the concentrations of HCl and H2SO4 on corrosion ratesand inhibition efficiencies(Page No. 112)

Figure 5.10 Arrhenius plot for mild steel in (a) 1 M HCl and (b) 0.5 M H2SO4 withdifferent concentrations of Banana Peel Extracts(Page No. 114)

Figure 5.11 Transition state plots for mild steel in (a) 1 M HCl and (b) 0.5 M H2SO4 withdifferent concentrations of Banana Peel Extracts(Page No. 115)

Figure 5.12 Tafel polarization curves for mild steel with different concentrations of (a)RMPPE, (b) RIMPPE, and (c) ORIMPPE in 1 M HCl(Page No. 117)

Figure 5.13 Tafel polarization curves for mild steel with different concentrations of (a)RMPPE, (b) RIMPPE, and (c) ORIMPPE in 0.5 M H<sub>2</sub>SO<sub>4</sub>(Page No. 119)

Figure 5.14 Nyquist plots for mild steel in 1 M HCl in presence of (a) raw, (b) ripe, and (c) over ripe banana peels extracts. (d) Equivalent electrochemical circuit for simulation of the experimental results (Page No. 121)

Figure 5.15 Nyquist plots for mild steel in 0.5 M H2SO4 in presence of banana peelsextracts at room temperature(Page No. 122)

 Figure 5.16 Nyquist plots and bode plots showing relation between experimental and simulated results
 (Page No. 123)

Figure 5.17 Bode plots for mild steel without and with different concentration of (a) raw, (b) ripe, and (c) over ripe banana peel extracts. (d) and (e) Bode plots for banana peel extracts in 0.5 M H<sub>2</sub>SO<sub>4</sub> (Page No. 125)

**Figure 5.18** 3D AFM images of mild steel (a) prepared, (b) corroded in 1 M HCl, (c) inhibited by RMPPE, (d) inhibited by RIMPPE and (e) inhibited by ORIMPPE (Page No. 127)

**Figure 5.19** 3D AFM images of mild steel (a) corroded 171 in 0.5 M  $H_2SO_4$ , (b) inhibited 72 by RMPPE, (c) 86 inhibited by RIMPPE and (d) 92 inhibited by ORIMPPE (Page No. 128)

**Figure 5.20.** SEM images of (a) mild steel, (b) corroded sample in 1 M HCl, (c) corroded sample in 0.5 M  $H_2SO_4$ , (d) & (e) inhibited by raw extract in HCl and  $H_2SO_4$ , (f) & (g) inhibited by ripe extract in HCl and  $H_2SO_4$  and (h) & (i) inhibited by ripe extract in HCl and  $H_2SO_4$  and (h) & (i) inhibited by ripe extract in HCl and  $H_2SO_4$  and (h) & (i) inhibited by ripe extract in HCl and  $H_2SO_4$  solutions (Page No. 129)

Figure 5.21Schematic explanation of corrosion inhibition activity of banana peelextracts(Page No. 131)