coatings

Supplementary Materials: Solution Based Coating of Mild Steel with *Spilanthes acmella* Leaves Extract for Corrosion Inhibition in Acid Medium

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Table S1. FT-IR spectral data of aqueous extract of SA leaves.

Observed IR Absorption Band (cm^{-1})	Assignment
3401	O-H stretch
2924	C-H stretch
2854	C-H stretch
-	C=N
1742	C=O stretch
1630	C=O stretch
1560	C-C in aromatic rings
-	C-H bend
1384	C-O-C stretch
-	C-O stretch
1113	C-O stretch
-	Substituted benzene
696	CH"OOP"
696	CH"OOP"

Table S2. FT-IR Spectral data for the aqueous leaf extract of SA and the scratched film from mild steel surface after immersion in 1.0 M HCl with 10% SA.

IR Bands of Crude Plant Extract	IR Bands of Film from Mild Steel Surface	Frequency Assignment
3401.3	3431.0	-OH(alcoholic)
2924.2	2855.4	C-H
2854.1	2924.6	C-H
1742.7	-	-C=O stretch
1630.7	1632.0	C=C in organic ring
1560.0	-	C-C in aromatic ring
1384.8	1384.7	-C-O-C-
1113.5	-	C-O stretch
1022.5	1036.1	C-O stretch
870.6	-	C-Cl stretch

696.0	667.9	CH"OOP"
-	471.2	Y-Fe_2O_3
-	571.2	Y-Fe_2O_3

3.6.2. Analysis and Electrochemical Impedance Spectroscopy

3.6.2.1. Nyquist Plots

The measurement of double layer capacitance, C_{dl}, gives the information about adsorption and desorption process and also the protective layer formation on the electrode surface [49]. The double layer capacitance, C_{dl} and charge transfer resistance, R_{ct} for the mild steel corrosion in 1.0 M HCl for the addition of different concentrations of the SA-LE at room temperature were determined from the Nyquist plots and are shown in Table S3.The observed increase in the R_{ct} value and decrease in the C_{dl} value with the increasing addition of all the studied leaves extract show that the components presents in the extracts are adsorbed on the mild steel surface [50]. The Nyquist plot for the corrosion of mild steel in 1.0 M HCl in the absence and in the presence of the inhibitor of low and high concentrations is shown in Figure S1 [51].

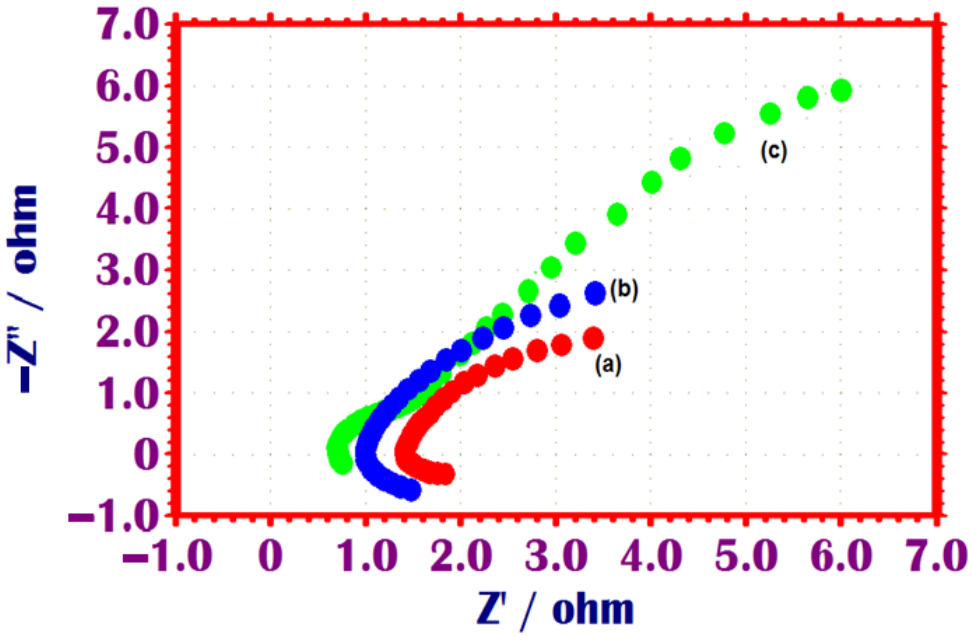

Figure S1. Nyquist plot for the corrosion of (**a**) mild steel in 1.0 M HCl without inhibitor (**b**) with 2% and (**c**) with 10% aqueous leaf extract of SA.

Table S3. Electrochemical impedance parameters from Nyquist plot and bode plot for the corrosion of mild steel without and with the various concentrations of aqueous SA leaves extract in 1.0 M HCl.

Concentration of the Aqueous Leaves Extract (% v/v)	Nyquist Plot			Bode Plot	
	R_{ct}, Ω cm^2	C_{dl} , μF/cm^2	Inhibition Efficiency (%)	Impedance, log(Z/Ω)	Phase Angle, -Phase/deg
Blank	**1.546**	**5.2006×10^{-6}**	**-**	**0.3167**	**31.10**
2	**1.919**	**8.582×10^{-7}**	**83.5**	**0.4254**	**39.95**
10	**5.2303**	**3.149×10^{-7}**	**93.9**	**1.0329**	**47.48**

3.6.2.2. Bode plots

Bode plots are obtained from the plot of log (Z/ohm) Vs. log (freq/Hz) and –phase/deg Vs. log (freq/Hz). Using these plot, the impedance value and the phase angle (θ), are calculated and given (Table S3). The Bode plots for mild steel corrosion in 1.0 M HCl without inhibitor (Figure S2) and the Bode plots for mild steel corrosion in 1.0 M HCl with 2% and 10% of SA-LE are shown in Figures S3 and S4.The phase angle and impedance values increase with increasing inhibitor concentration**s** [52]. The shape of the curves shows that the adsorption of the inhibitor molecules by the replacement of water molecule from metal surface takes place a single step.

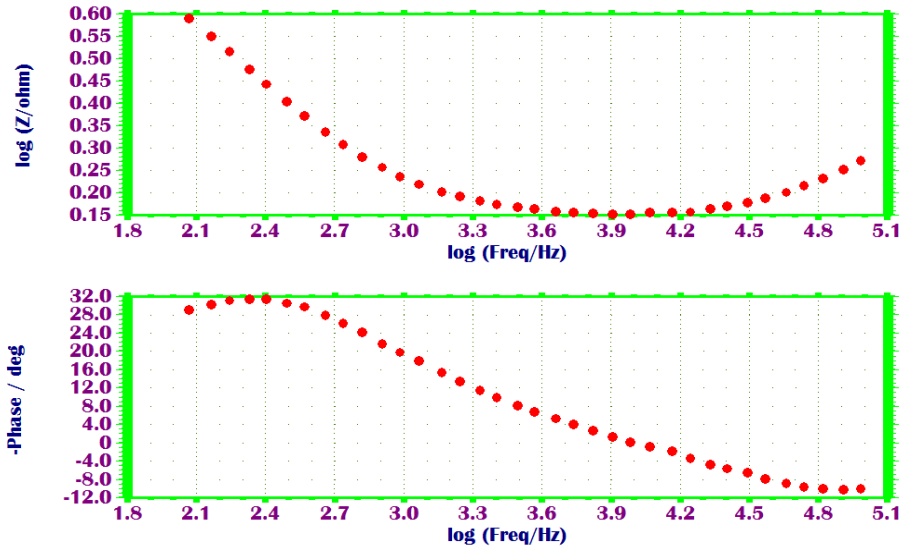

Figure S2. Bode plots for the corrosion of mild steel in 1.0 M HCl without inhibitor.

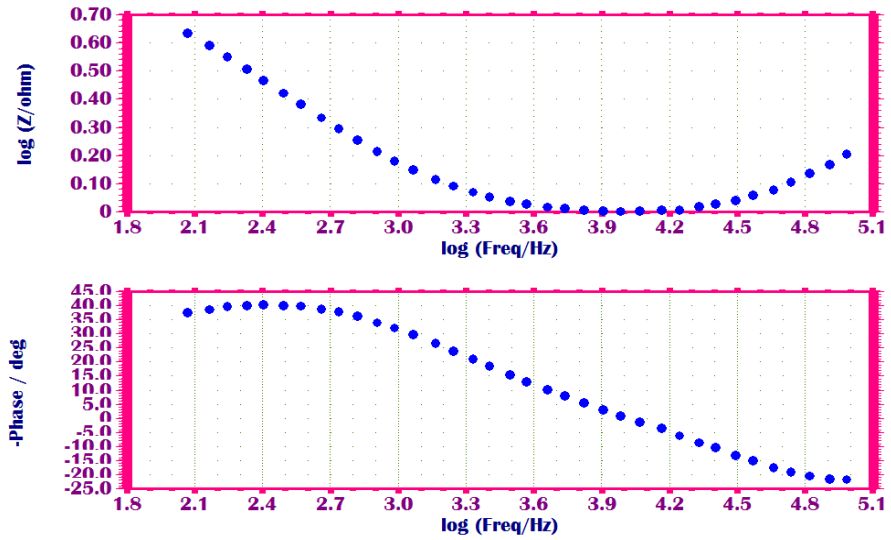

Figure S3. Bode plots for the corrosion of mild steel in 1.0 M HCl with 2% SA-LE inhibitor.

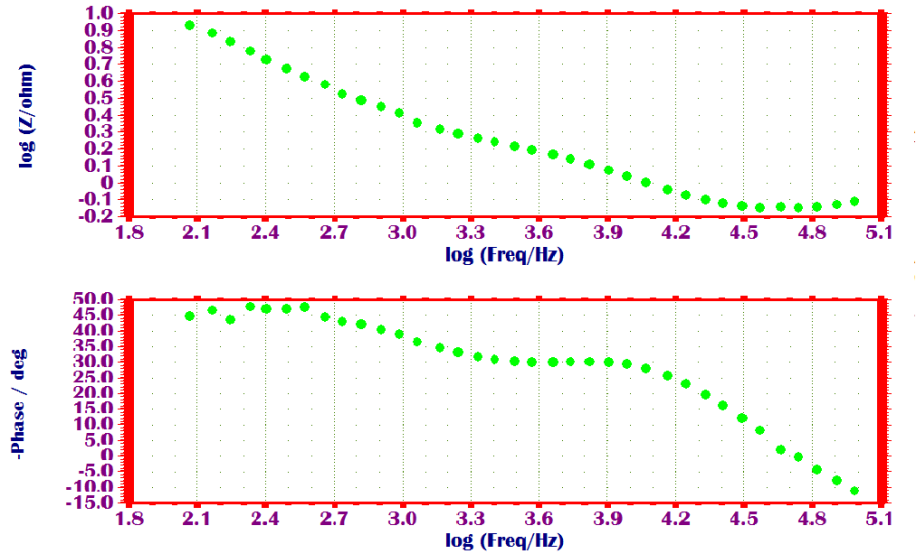

Figure S4. Bode plots for the corrosion of mild steel in 1.0 M HCl with 10% SA-LE inhibitor.

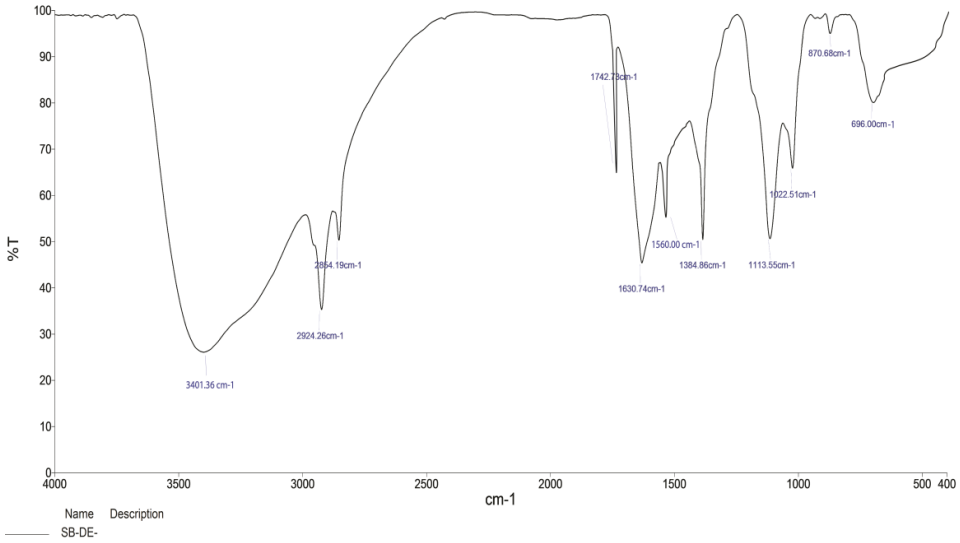

Figure S5. FT-IR spectrum of aqueous leaf extract of SA.

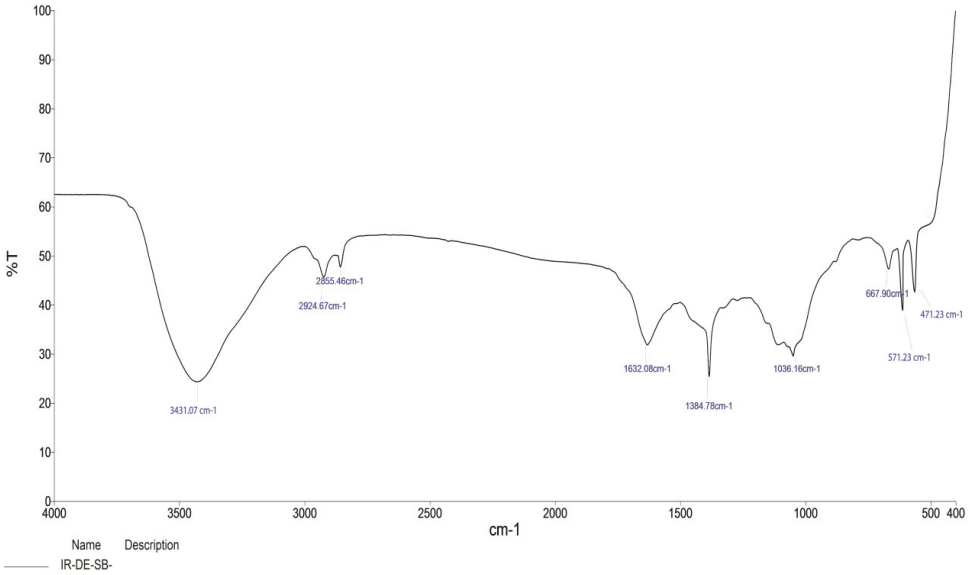

Figure S6. FT-IR spectrum of scratched film from the mild steel surface after immersion in 1.0 M HCl in the presence of 10% aqueous leaf extract of SA.