

# Corrosion Inhibition of Mild Steel in Seawater through Green Approach using *Leucaena leucocephala* Leaves Extract

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# OUTLINE

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- 01 INTRODUCTION**
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- 03 RESULTS & DISCUSSION**
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# INTRODUCTION



1

Corrosion: Deterioration of metal-based material resulted from interaction with the environment leading to the total failure of a structure [1].

2

Reports from U.S. Department of Transportation for the period of 6 years between 1994 and 1999 suggest that approximately 25% of all reported accidents related to the pipeline system were due to corrosion [2].

3

Inorganic inhibitor i.e. phosphate and chromates pose major threat due to hazardous property [3].

Organic inhibitor i.e. hydrazine, benzotriazole and thiourea also pose same threats [4].

4

Current research shifted towards the use of natural resources as a substitution to produce green corrosion inhibitor.

# INTRODUCTION



## Our Focus

To formulate and create a brand new effective inhibitor out of natural resources



## Globally & Locally

A variety of natural resources are distributed across the world.



## Testing & Analyzing

The created product must be tested and carefully analyzed to study its efficiency and the presence of any negative impacts.



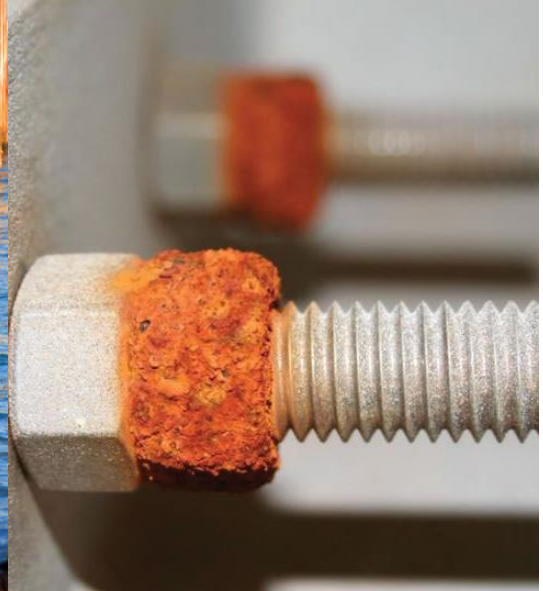
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**Pipelines**



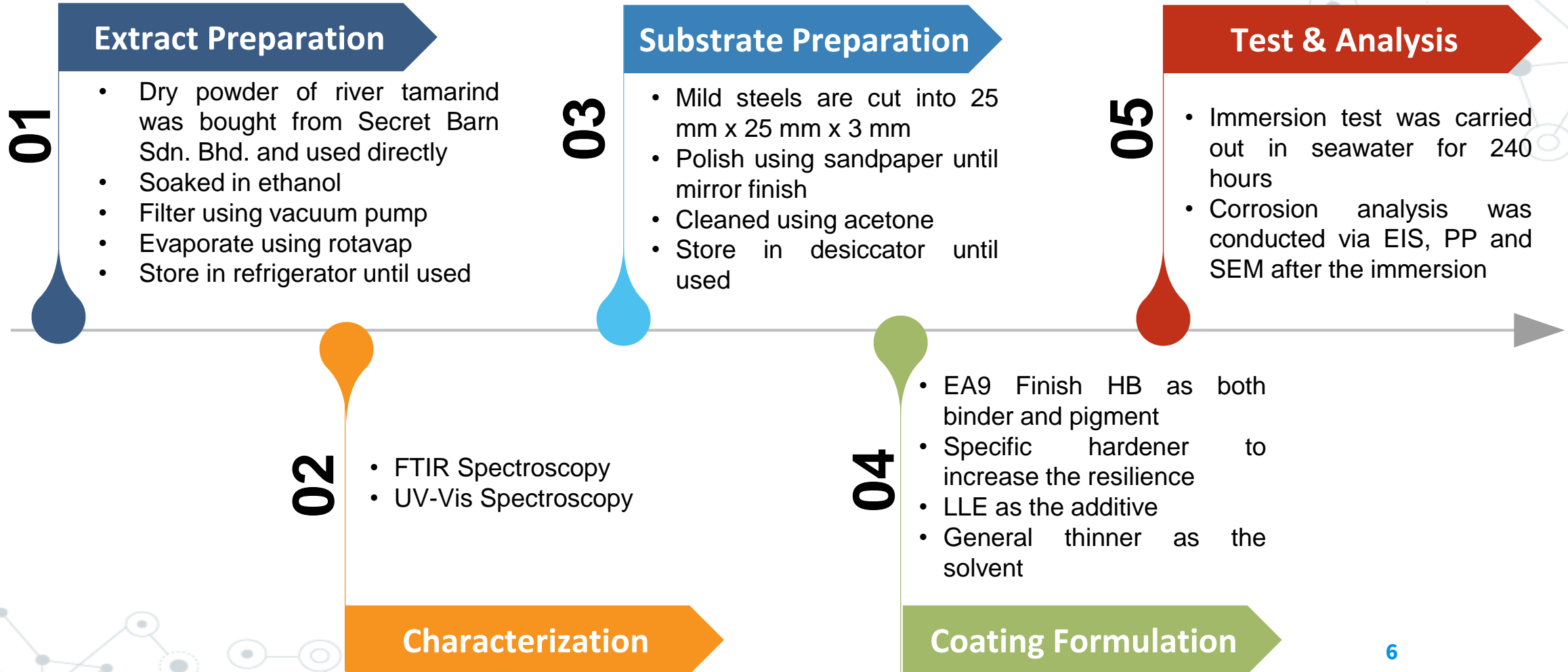
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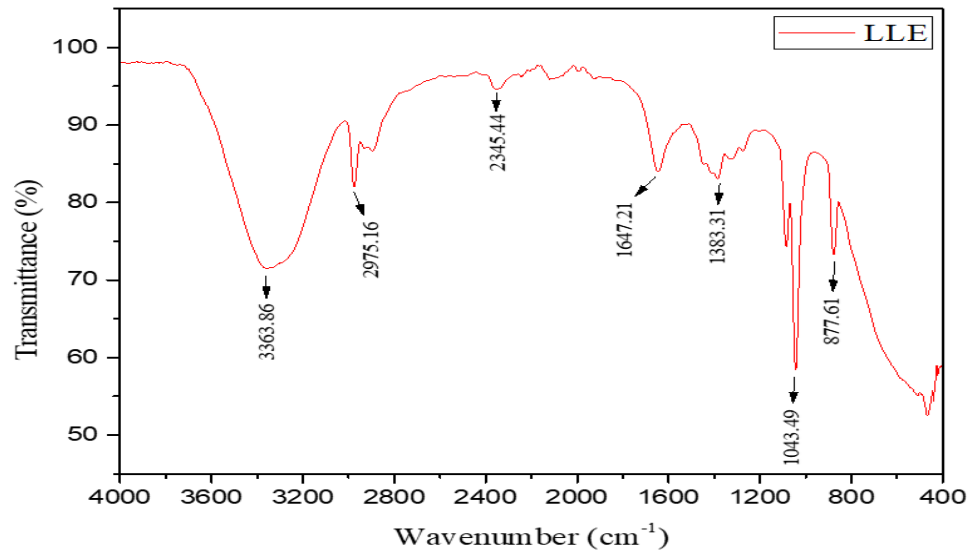
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# METHODOLOGY



# RESULTS & DISCUSSION (FT-IR & UV-VIS SPECTRA)



FT-IR

Figure 1: FT-IR spectrum of river tamarind leaves extract

Table 1: FT-IR Absorption Characteristic

Absorption (cm <sup>-1</sup> )	Appearance	Group	Compound Class	Comment
3363.86	Strong & Broad	O-H stretching	Alcohol	Intermolecular bonded
2975.16	Strong	O-H stretching	Carboxylic Acid	Commonly centered around 3000 cm <sup>-1</sup>
2345.44	Strong	O=C=O stretching	Carbon Dioxide	-
1647.21	Strong	C=O stretching	Amide	-
1383.31	Medium	C-H bending	Alkane	-
1043.49	Medium	C-N stretching	Amine	-
877.61	Strong	C-H bending	1,2,4-trisubstituted benzene	A type of benzene

UV-VIS

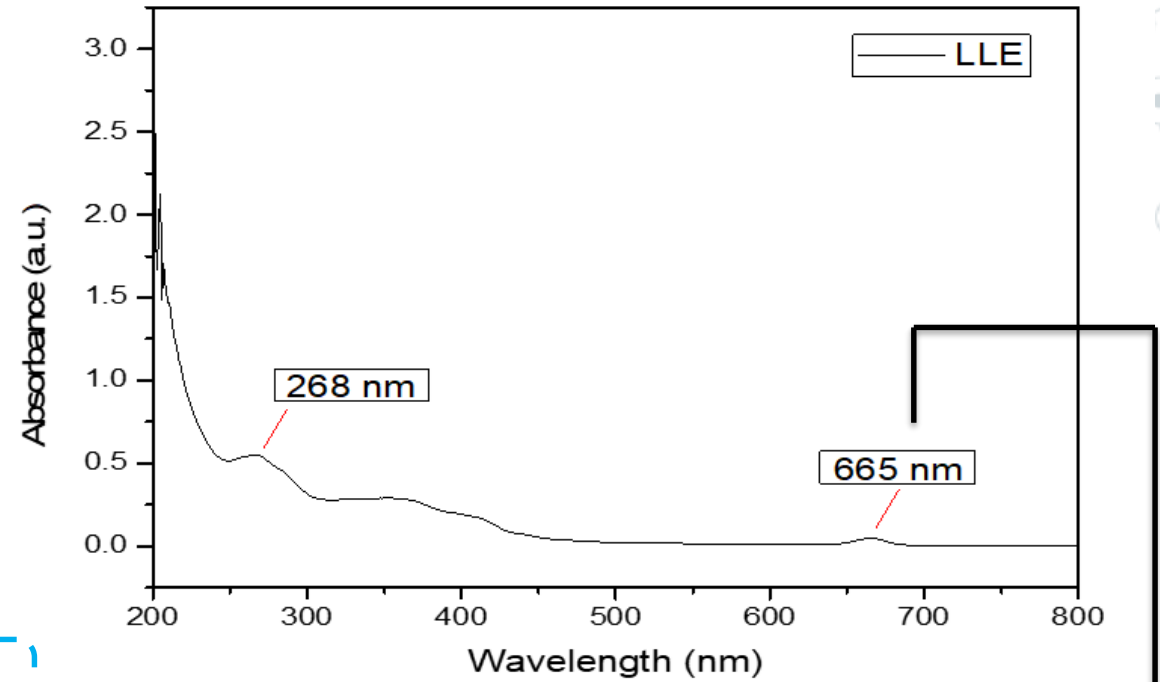


Figure 2: UV-Vis spectrum of river tamarind leaves extract

A small noticeable peak in red and near infrared region; can be attributed to chloroplast.

# RESULTS & DISCUSSION (EIS & PP)

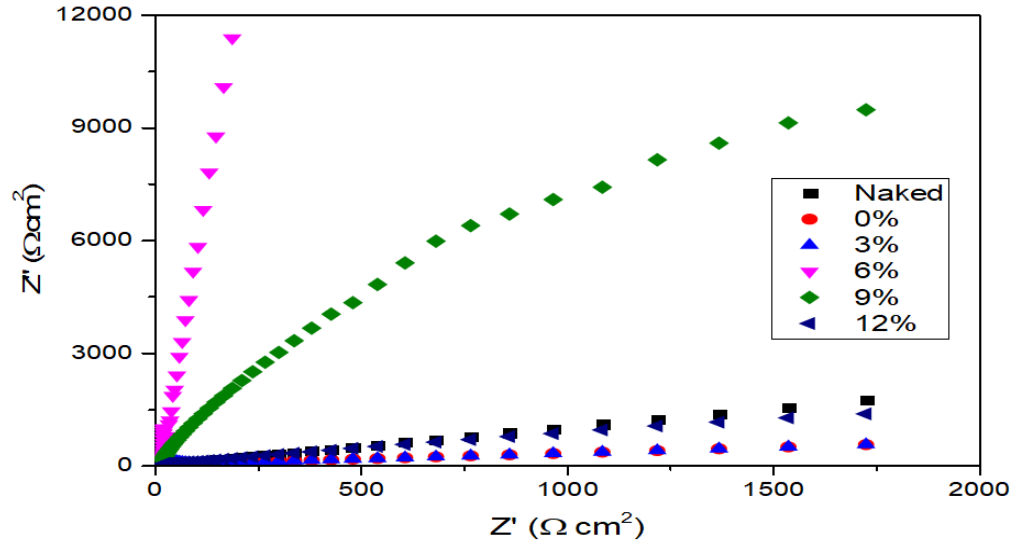


Figure 3: Nyquist plot for coated and uncoated mild steels immersed in seawater

Table 2: Impedance Parameter of Mild Steel Immersed in Seawater

Coating (%)	$R_{ct}$ ( $\Omega \text{ cm}^2$ )	$\eta$ (%)
Naked	1532	-
0%	1452	5.51
3%	2063	25.74
6%	39443	96.12
9%	5257	70.86
12%	734	8.72

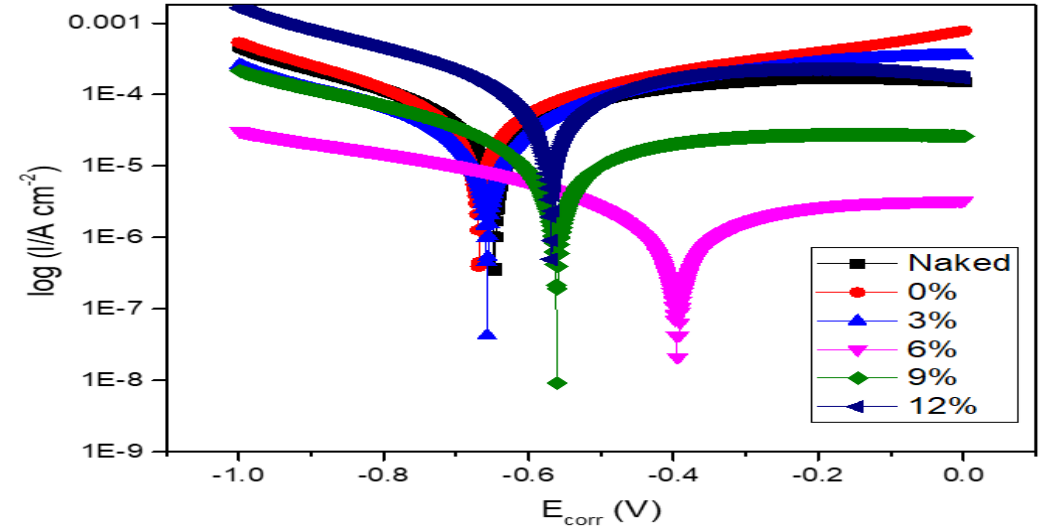
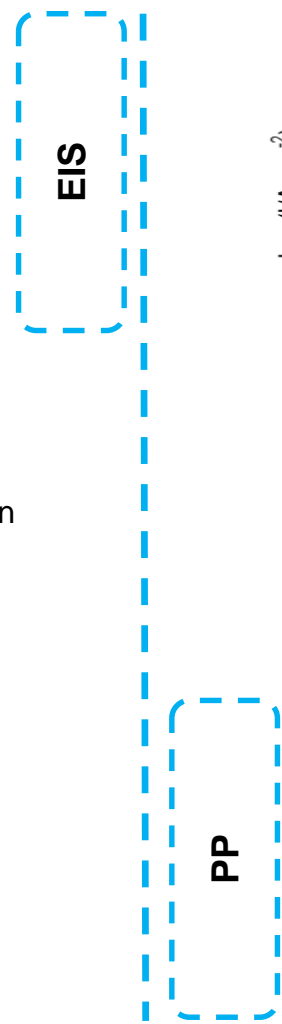


Figure 4: Tafel plot for coated and uncoated mild steels immersed in seawater

Table 3: Corrosion Parameter of Coated and Uncoated Mild Steels Immersed in Seawater

Sample	$ b_a $ ( $\text{V dec}^{-1}$ )	$ b_c $ ( $\text{V dec}^{-1}$ )	$-E_{corr}$ (mV)	$I_{corr}$ ( $\text{A cm}^{-2}$ )	Corrosion Rate, CR (mm/year)
Naked	0.90545	3.72090	650.1	2.06E-04	2.3991
0%	0.48766	0.72167	668.5	1.01E-04	1.1733
3%	0.63268	0.47454	657.3	5.71E-05	0.6633
6%	1.07080	1.76230	394.4	2.49E-05	0.2791
9%	0.46838	1.51160	561.0	3.75E-05	0.4361
12%	0.32002	0.55936	571.2	1.20E-04	1.3990



## RESULTS & DISCUSSION (SEM)

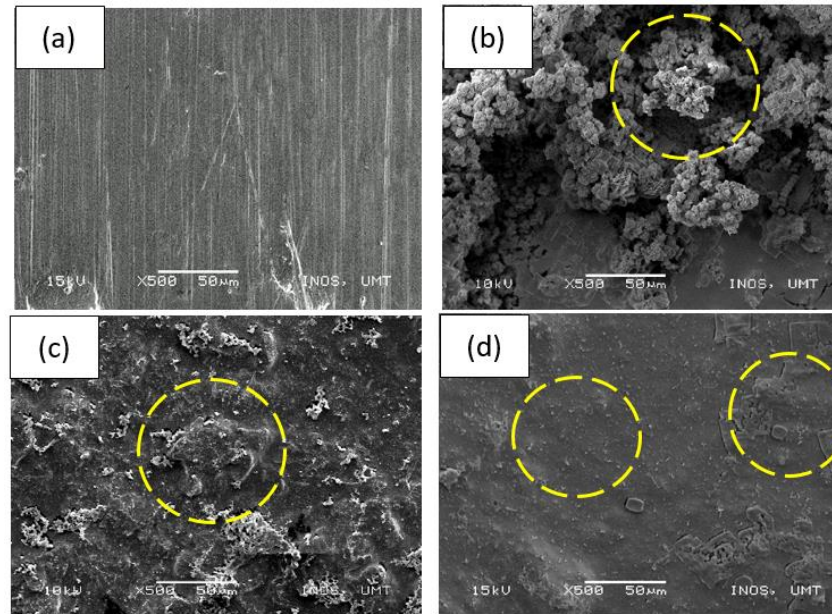


Figure 5: SEM images of (a) freshly polished mild steel coupon, (b) naked mild steel, (c) mild steel with 0% LLE coating and (d) mild steel with 6% LLE coating after 240 hours of immersion in seawater

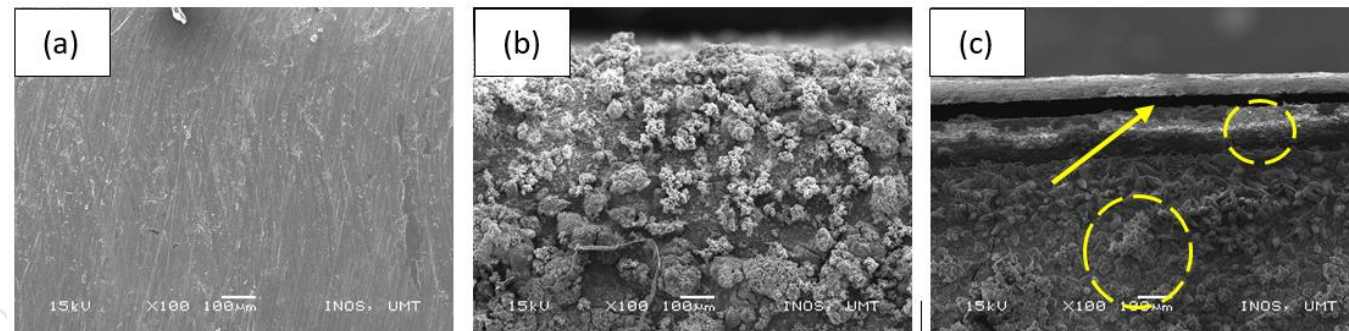


Figure 6: SEM images of cross-sectional area of (a) freshly polished mild steel coupon, (b) naked mild steel and (c) mild steel with 6% LLE coating after 240 hours of immersion in seawater

## CONCLUSION

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The conclusion based on the research conducted are as follows:

1. The coating produced by integrating the extract of river tamarind with a local paint proved to be successful and able to protect the mild steel against the damage of corrosion to a certain extent when immersed in seawater.
2. Analysis via FT-IR confirms the presence and the involvement of several functional groups such as hydroxyl and carbonyl groups which proposedly supplies the neutral molecules for the inhibition mechanism.
3. The analysis conducted through electrochemical studies indicate the efficiency of the coating increases with the increase of LLE concentration until a certain limitation or optimum value is achieved. On the other hand, the study also implies that the coating acts as a mixed type coating where it reduces progress of corrosion on both anodic and cathodic site.
4. Based on the observation via SEM, the surface of coating with the optimum concentration of LLE shows a smooth and well distributed layer with no sign of cracks and pores indicating the improvement in its capabilities when compare to the observation of the same coating without the presence of extract. This demonstrate a remarkable used of natural resources as a viable method in improving the present corrosion inhibitor.

## REFERENCES

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# Thanks!

**Any questions?**



You can find me at:

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