Functionalization of Citrus Pectin as a Green Corrosion Inhibitor for Gas Pipelines

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Research question: To what extent is citrus pectin an effective green corrosion inhibitor for gas pipelines?

Background

- The U.S. economy incurs an annual cost of $276 billion due to corrosion.
- Common corrosion inhibitors like N-Methyl Diethanolamine are widely used in industry and effective but not environmentally friendly.
- Citrus pectin, a renewable biopolymer, is traditionally used as a gelling agent, but now being used for broader applications.

Future Work

- Optimization of citrus pectin by potentially adding polymers or additives, or testing different concentrations.
- Environmental impact testing of citrus pectin compared to standard corrosion inhibitors.
- Testing with different types of steel to observe variable effects.

Acknowledgements

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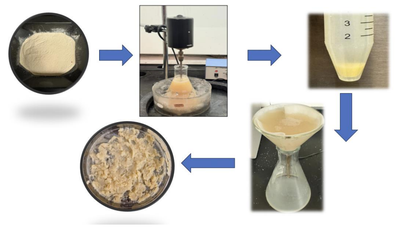
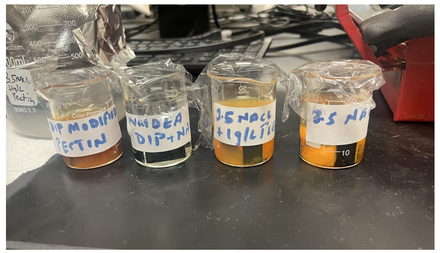
Research Methods

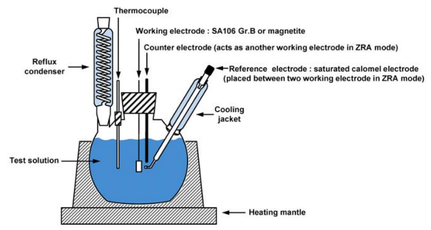
Step 1: Modify Citrus Pectin



Step 2: Analysis Using Weight



Step 3:Analysis with Electrochemistry

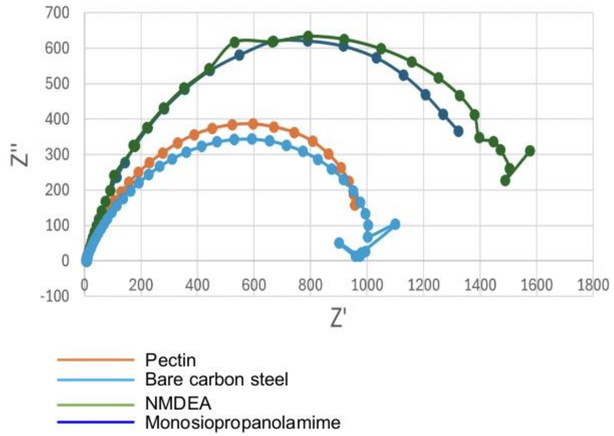


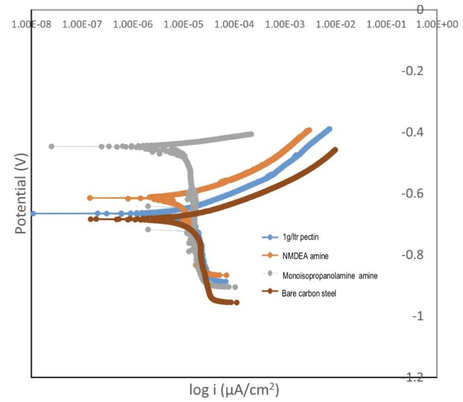
References

1.Koch, G. H., Brongers, M. P., Thompson, N. G., Virmani, Y. P. & Payer, J. H. *Corrosion cost and preventive strategies in the United* production – a review. *Appl. Surf. Sci. Adv.* **6**, 100128 (2021).

Results

Sample	E_{corr} (mV)	Icorr (μA/cm²)	CR (mmpy)	Inhibition efficiency (%)
NMDEA	-612.88	10.372	0.1194	54.10
Monoisopropanolamine	-444.41	13.69	0.158	39.424
Pectin 1g/Ltr	-664.99	19.789	0.2300	12.4
Bare Carbon steel	-683.5	22.6	0.261	-





Sample	Rs (solution resistance) (Ω cm²)	RP (Polarization resistance) (Ω cm²)	CPE (constant phase element) (F/s)	n	Inhibition efficiency (%)
EIS NMDEA	6.76	1662.3	$5.5 * 10^{-4}$	0.83736	37
EIS Monoisopropanolamine	6.74	1509.2	$5.5 * 10^{-4}$	0.83553	30.61
EIS NACL 3.5 1 PECTIN	6.0	1247.4	$2.32 * 10^{-4}$	0.76676	16
Bare carbon steel	4.964	1047	$4.3 * 10^{-4}$	0.79745	-

Before and after	Inhibtior	Average Weight(g)	Weight Loss(g)	Corrsion pecentage(%)	Inhibition effciency(%)
Before corrsion	Control Sample	3.8212	0.0091	-0.2381	
After corrsion	(Pure NaCl)	3.8121			
Before corrsion	3.5 NaCL with Pectin	3.78071	0.00882	-0.2333	3.1746
After corrsion	in Solution 1g/L	3.77189			
Before corrsion	Dipped modified	3.81407	0.00593	-0.1556	53.3708
After corrsion	pectin	3.80813			
Before corrsion	Amine Dip N Methyl-	3.7854	0.0049	-0.1294	85.7143
After corrsion	Diethanol Amine(99%)	3.7805			

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