



Green Corrosion Inhibition (P99)

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Abstract: The efficiency of *Theobroma cacao* (Cocoa) Shells methanol extract (TCS) in inhibiting corrosion of mild steel was studied for 85 days in 2M H₂SO₄ containing increasing (v/v%) concentrations of TCS. Gravimetric and Electrochemical analyses were conducted to give corrosion rates and inhibition efficiency values which indicated that the best inhibition was obtained at the highest concentration of extract used.

Introduction: Metallic corrosion is an electrochemical reaction that occurs when a material interacts with its environment resulting in its gradual degradation¹. This leads to huge losses in the global economy, namely in the repair and replacement of steel structures and equipment¹. Solutions developed to curb the exorbitant expenditure have resulted in the environmental accumulation of toxic chemicals for which green corrosion inhibitors (GCI's) are seen as the eco-friendly, cheaper alternative.

Note: This research is meant to contribute to the success of the United Nation's 17 Sustainable Development Goals, namely, goals 9, 7, 11 and 8. By using GCI's, we can build sustainable infrastructure; promote the use of cleaner energy; make resilient cities and boost economies by redirecting funds otherwise used in repairs to foster growth and development of other sectors in societies.

Method:

1. Coupons were manually cleaned, polished and stored in a desiccator.
2. *Theobroma cacao* Shells were dried, ground and soaked in distilled Methanol for 48 hours.
3. Extract was filtered and refrigerated.
4. Coupons were suspended in 100 mL of corrosive solution containing H₂SO₄, TCS Extract and de-ionised water.
5. Weekly readings of weight loss, Tafel plots and E. I. S. were conducted for 28 days.
6. Readings were then taken every 28 days thereafter for 85 days.
7. Analyses include - Weight loss, Surface Area Coverage, Tafel Plots, E. I. S., Corrosion rates and Inhibition Efficiencies.

Results:

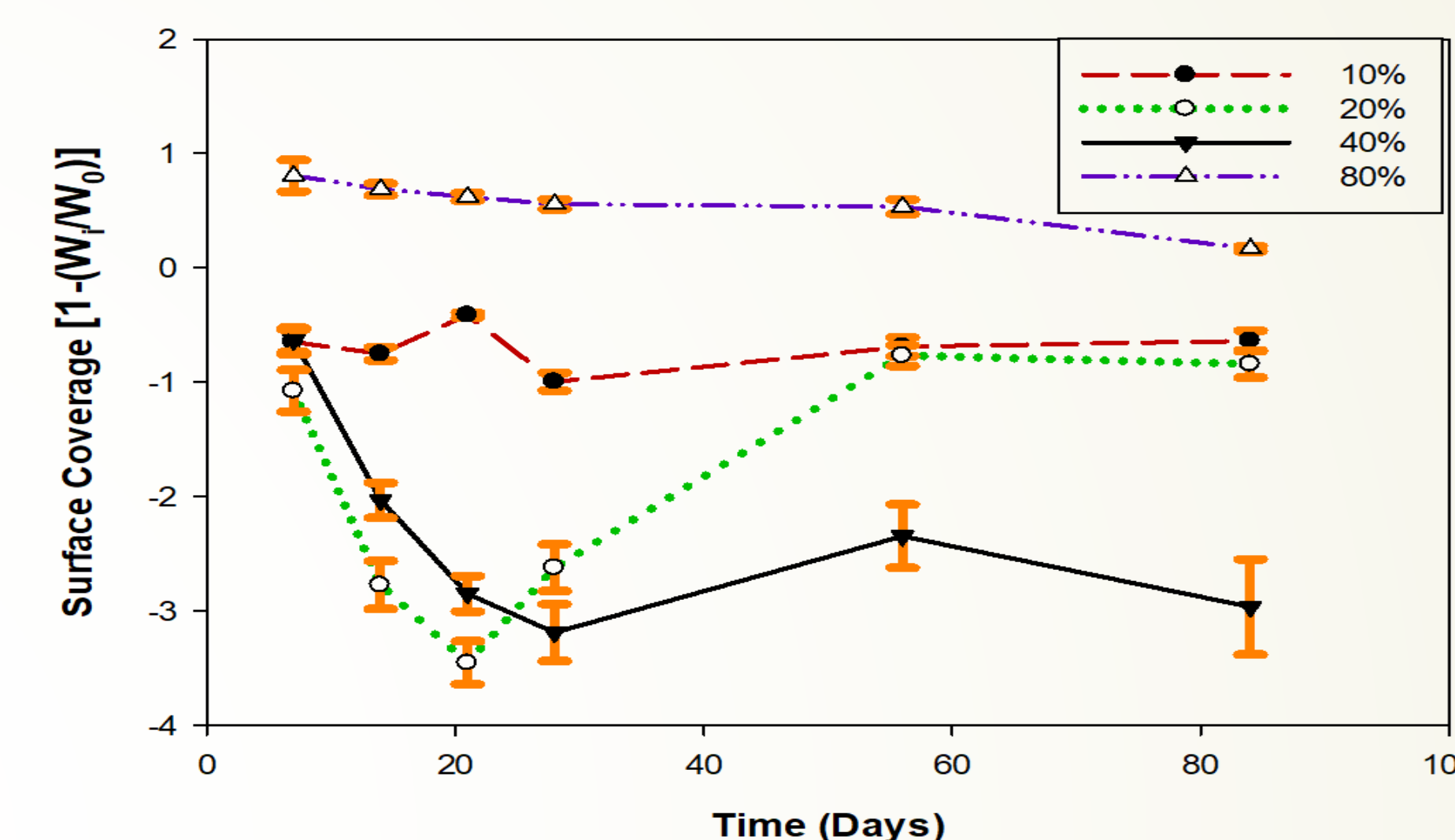


Figure 1: Surface Coverage of TCS Extract on coupons. Error bars represent 95% C. I.

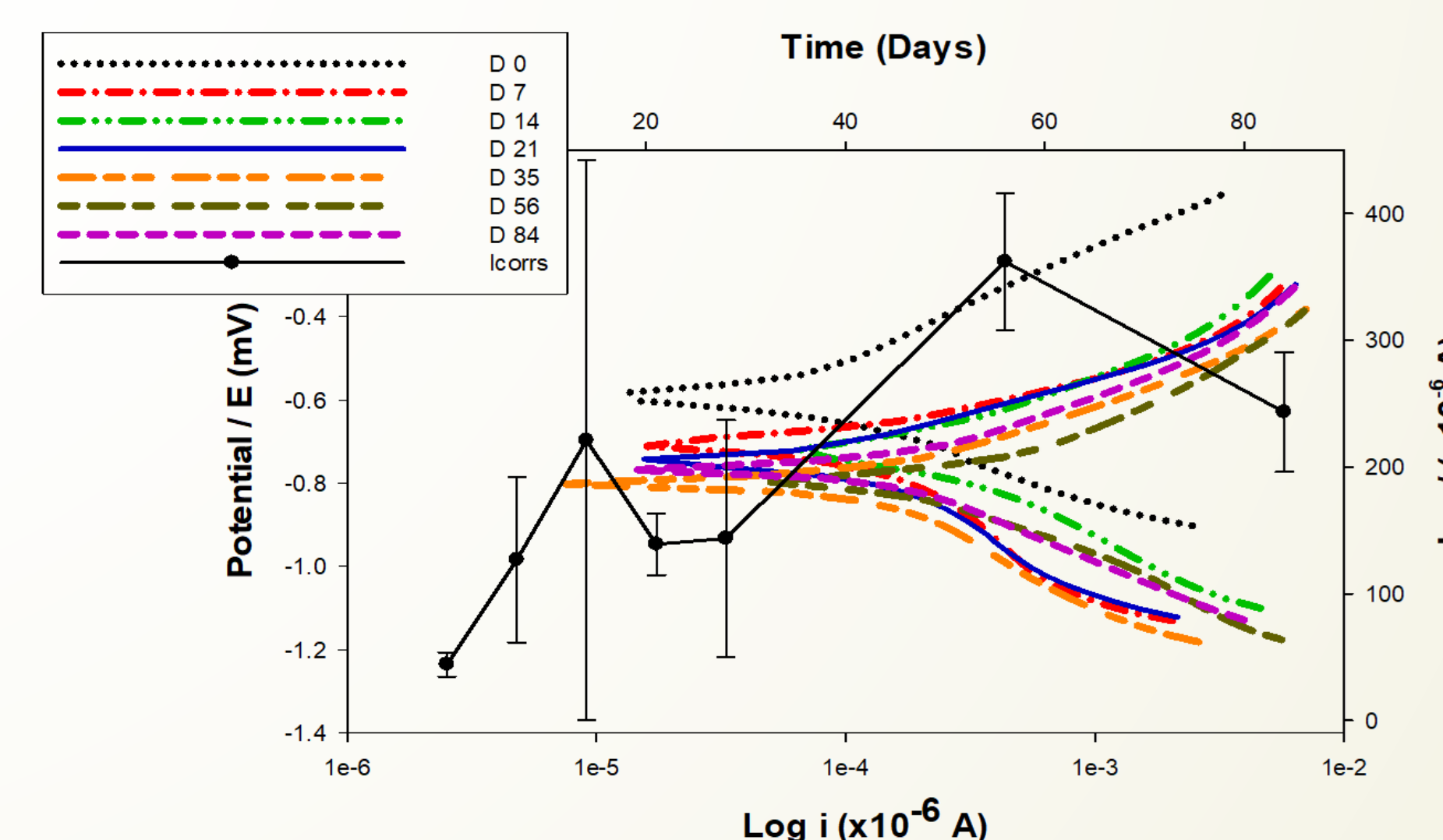


Figure 2: Tafel Plot of 80% [TCS] Extract with I_{corr} values. Error bars represent 95% C. I.

Conclusion: *Theobroma cacao* acts as a green corrosion inhibitor at the metal surface; producing a corrosion rates from 9.17×10^{-5} mmpy to 4.4×10^{-4} mmpy and inhibition efficiencies ranging from 53.4 % to 80.55 %.

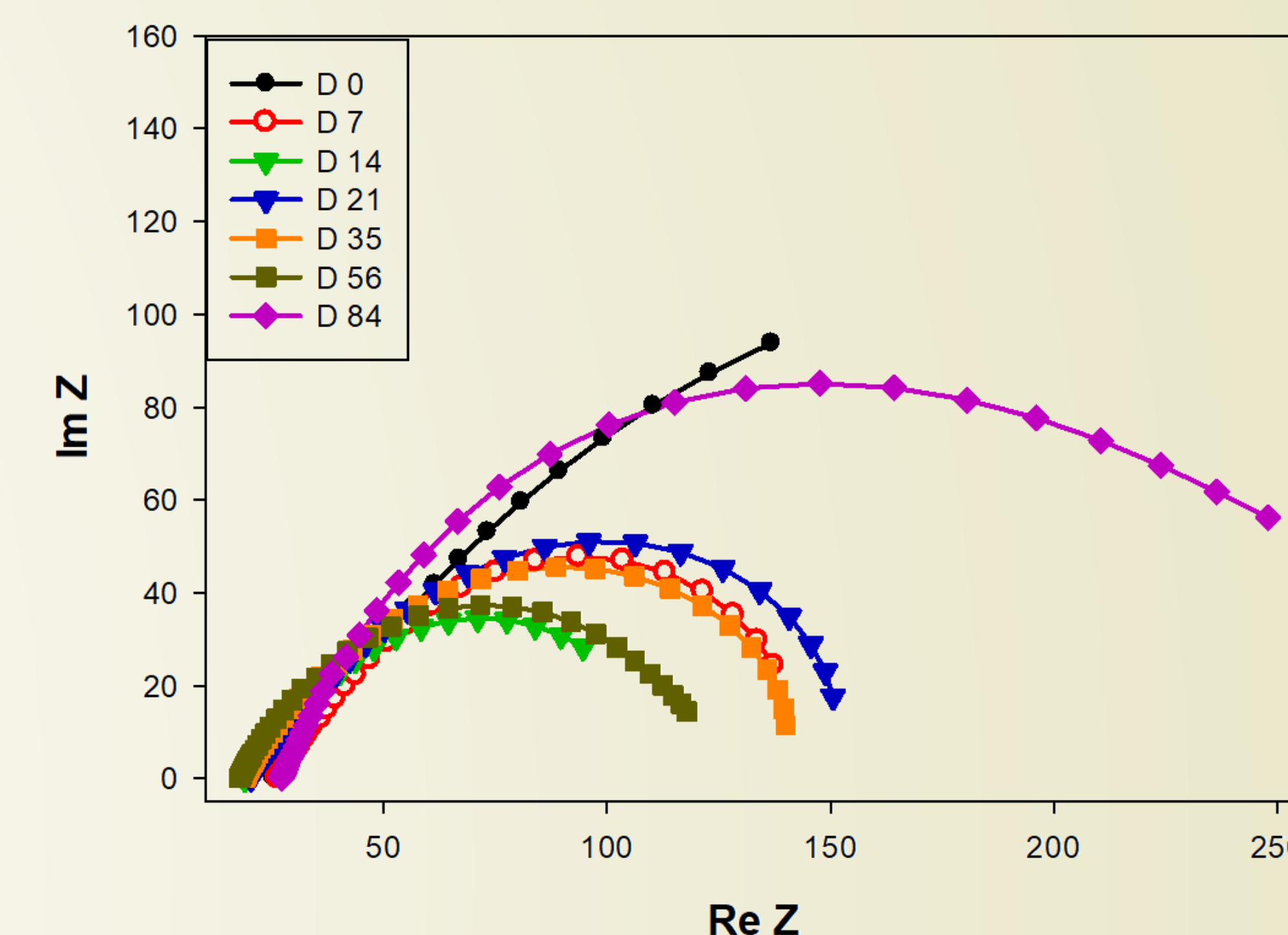


Figure 3: Nyquist Plot of 80% [TCS] Extract

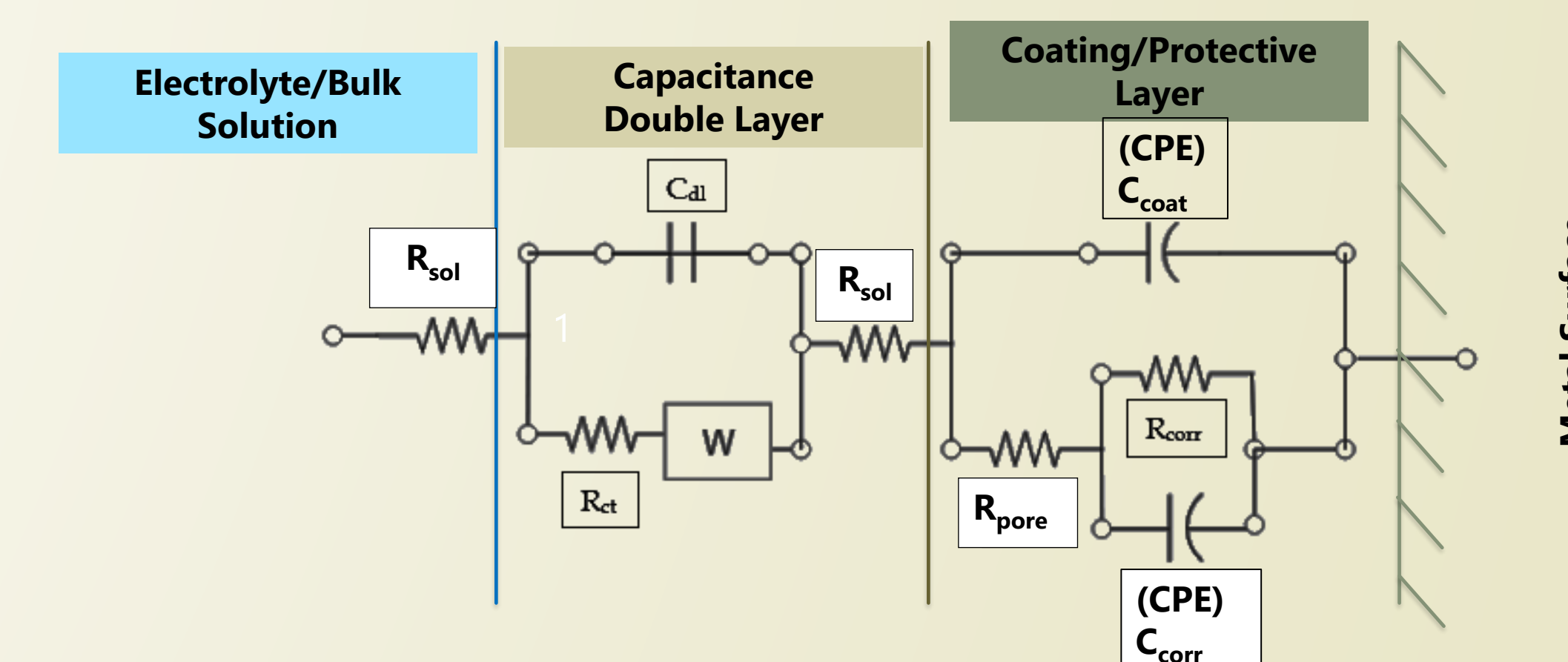


Figure 4: Equivalent Circuit representing the system at the electrode/electrolyte interface for coupons in 80% [TCS] Extract.