Fundamental study of surfactant behavior at the metal/electrolyte interface for corrosion inhibition

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1. OBJECTIVE: Investigate the relationship between the surfactant structures formed at the metal/electrolyte interface & their corrosion inhibition property to understand the molecular mechanisms of inhibition and develop the formulations with better performance.

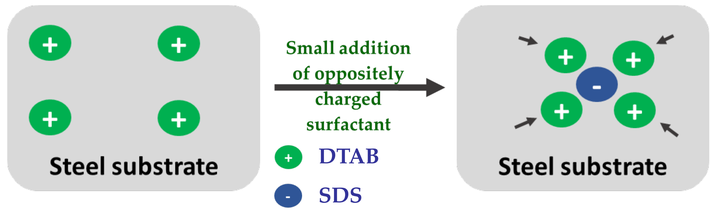
2. BACKGROUND

Scientific knowledge-gap: The exact role of surfactant aggregate structures in corrosion inhibition of metal surfaces is not well understood.

Intellectual Motivation: The structure of surfactant aggregates at the metal-electrolyte interface dictates its corrosion inhibition property which can be correlated to the films mechanical properties. AFM and EIS investigations at the interface can provide information required to understand the corrosion inhibition mechanism.

Industrial Relevance: Knowledge of molecular mechanisms of corrosion inhibition can be utilized to develop cost-effective inhibitor formulations.

3. THE DTAB:SDS SYSTEM



Tighter packing ➡ higher surface coverage ➡ Better corrosion inhibition

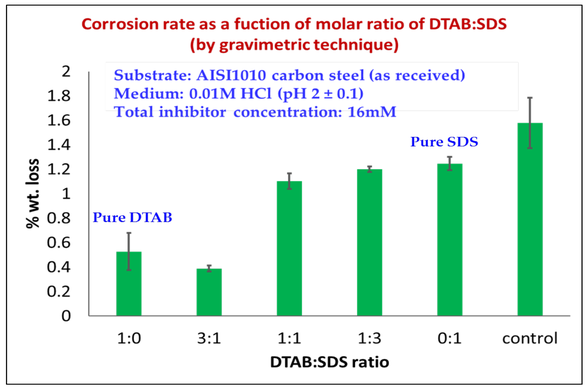
Experimental:

1. Different ratios of DTAB:SDS were explored to find out the ratio showing minimum corrosion of AISI1010 carbon steel coupons by gravimetric technique.
2. Effect of inhibitor concentration was determined using polarization resistance measurement under two conditions:
   1. 0.01M HCl (pH 2, no salt)
   2. 1wt% NaCl solution at pH 5

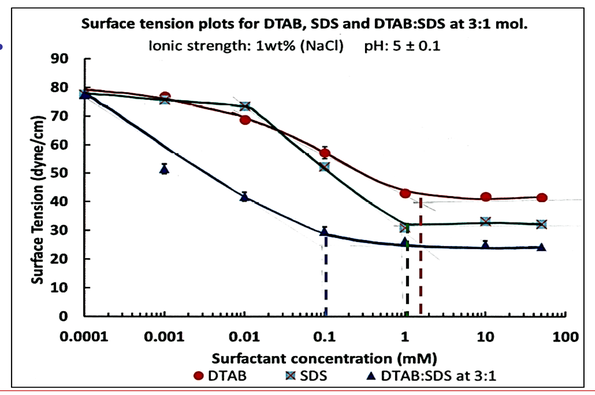
4. RESULTS & DISCUSSION

1. Gravimetric testing showed that 3:1 (DTAB:SDS) ratio was most effective resulting in least corrosion. (See Fig. A)
2. The 3:1 (DTAB:SDS) mixture does exhibits lower CMC than individual components
3. The 3:1 (DTAB:SDS) mixture is more effective than the pure DTAB system at both pH 2 and 5. (See Fig C and D).
4. There seems to exist the range of concentration over which the 3:1 mixture has more potential to inhibit corrosion than it's pure DTAB counterpart. (See the boxes in Fig C and D).

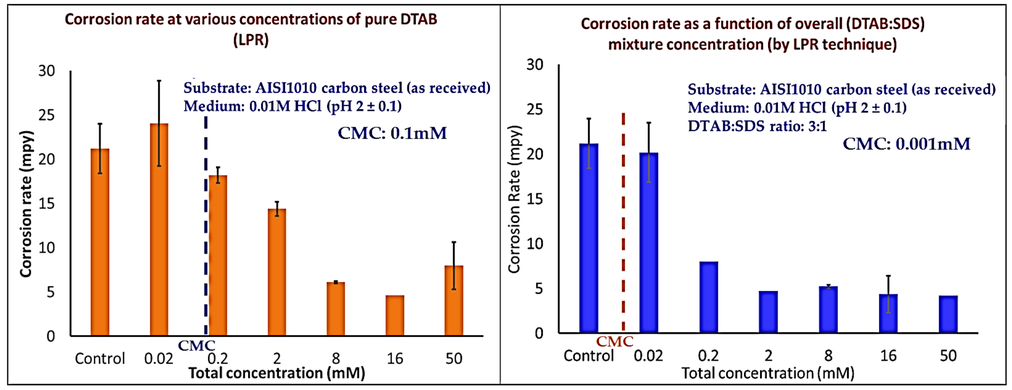
A.



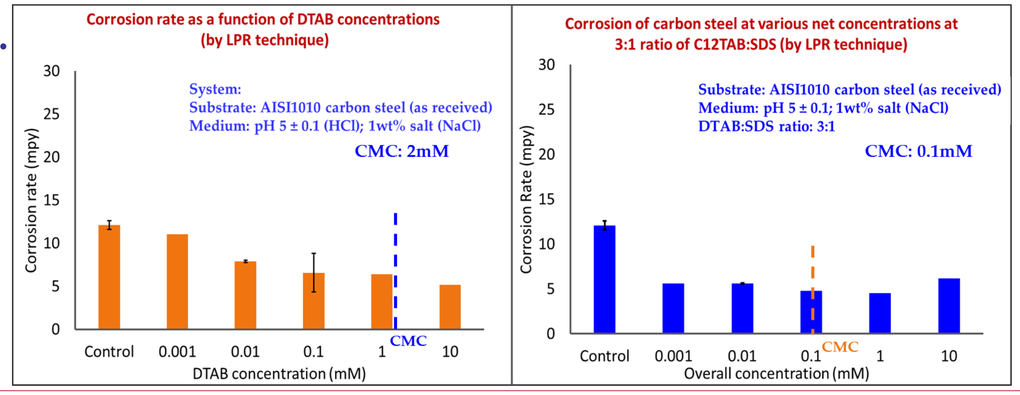
B.



C.



D.



5. KEY FINDINGS

- The 3:1 ratio of DTAB:SDS mixed surfactant system exhibits lower CMC than the individual counterparts as expected.
- 3:1 ratio of DTAB:SDS is most effective against the corrosion among the ratios tested.
- There seems to exist a range of concentration over which the mixed surfactant system is most effective.

6. FUTURE TASKS

- Investigation of corrosion inhibition of DTAB:SDS system using electrochemical measurements:
  - why the mixed surfactant system is more effective than the pure surfactant system only at lower concentrations
  - The effect of mixed surfactant system on the packing density through the EIS measurements
  - Comparison of corrosion inhibition of DTAB:SDS system with Imidazoline inhibitors.

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