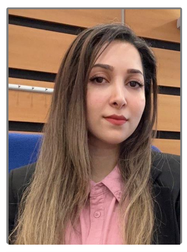

Retention and Release of Commercial and Purified Phosphonate Scale Inhibitors on Carbonate Substrate

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energi SIMULATION

BACKGROUND

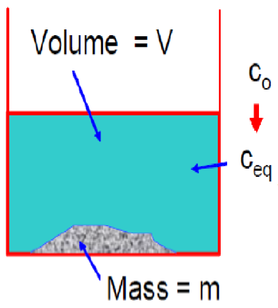
Mineral scales:

- Reduced production
- Increased costs
- Equipment damage

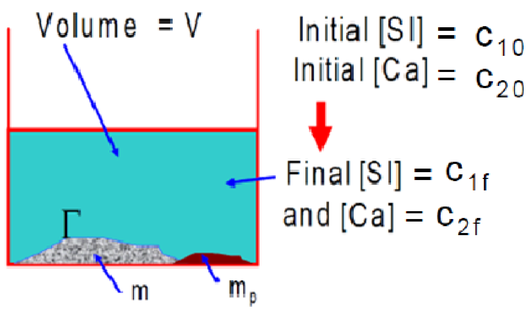
Scale inhibitors are chemicals that prevent the formation of scale. Controlled release of SI enhances the treatment's effectiveness (squeeze lifetime) and it is governed by 2 mechanisms:

1. Pure adsorption (Γ)

$$SI + n{\cdot}Ca \rightleftharpoons SI\_Ca_n$$



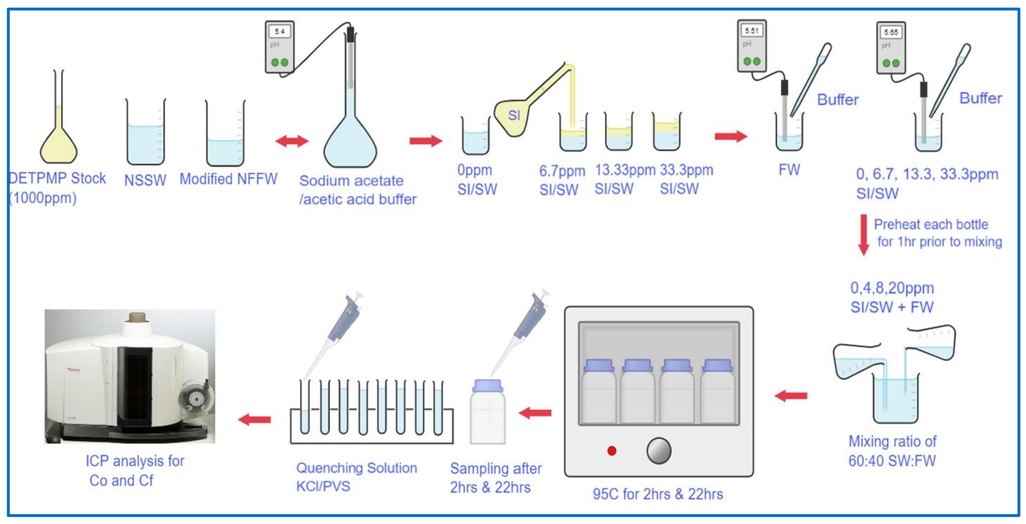
2. Coupled Adsorption/ Precipitation (Γ/Π):

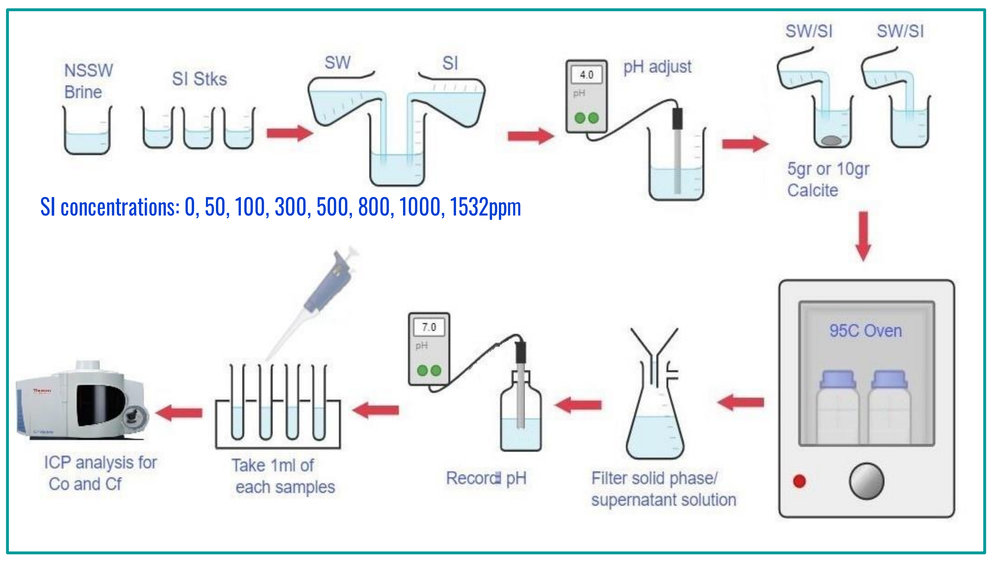


METHODOLOGY

Inhibition Efficiency of Commercial and Purified DETPMP

- Test Temperature: 95C
- pH_0 =~5.4
- SI stock concentrations after mix: 0, 4, 8, 20
- Sampling time: 2hrs, 22hrs
- Analyse the ion concentrations: Ba^{2+} and P before and after the experiment, i.e. initial and final concentrations.





Apparent adsorption/compatibility experiments (Γapp)

- Test Temperature: 95° C
- pH_0 =4
- Different Mass/Volume ratios
- Analyse the ion concentrations: P, Ca^{2+} , Mg^{2+}, Li^{+} before and after the experiment, i.e. initial and final concentrations.

WHY / PURPOSE

The main purpose of this study is to extend the current knowledge and understanding of

SI ↔ Carbonate ↔ Brine

interactions relating to SI squeeze treatments.

This part of the research focuses on phosphonate SI/M^{2+} precipitates, aiming to purify commercially available SIs.

- ✓ We compare the inhibition efficiency (IE), adsorption and precipitation behaviour of purified SI with industrial products.
- ✓ Determine the effect of temperature on precipitation behaviour and structure.
- ✓ Study the impact of purified SI on pH change patterns.

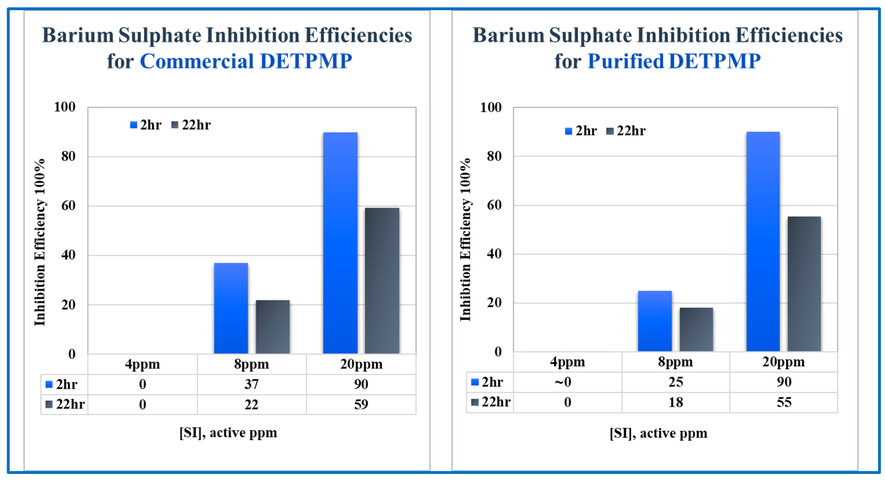
Future aims:

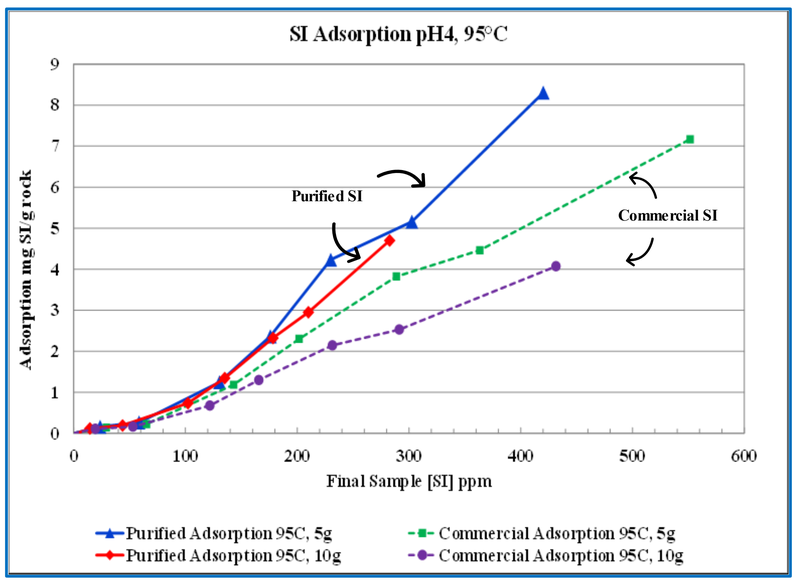
- Investigate associated supernatant solutions IE and precipitation performance
- Compositional breakdown of impurities
- Solubility of purified materials
- This work will contribute information to support SQUEEZE modeling

RESULTS

Inhibition Efficiency of Commercial and Purified DETPMP

- Equivalent IE for commercial DETPMP and purified DETPMP on barite inhibition
- The IE of both batches toward $BaSO_4$ inhibition decreases after 22 hrs compared to 2 hrs.

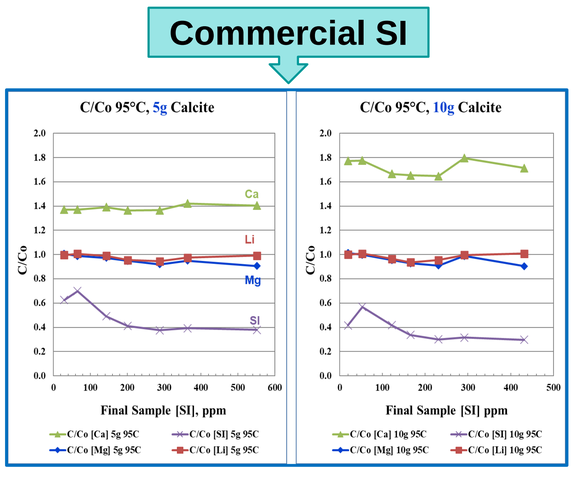


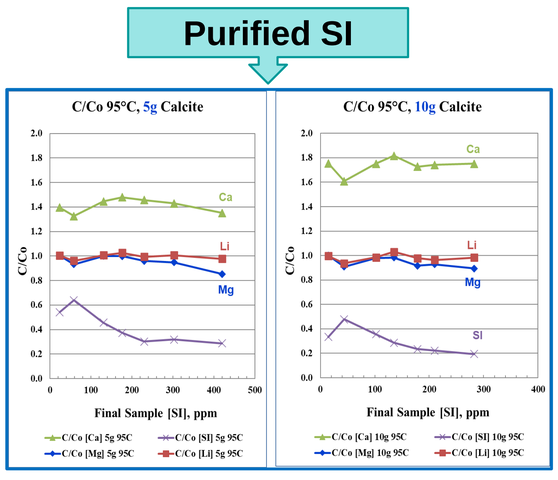


Apparent adsorption/compatibility experiments (Γapp)

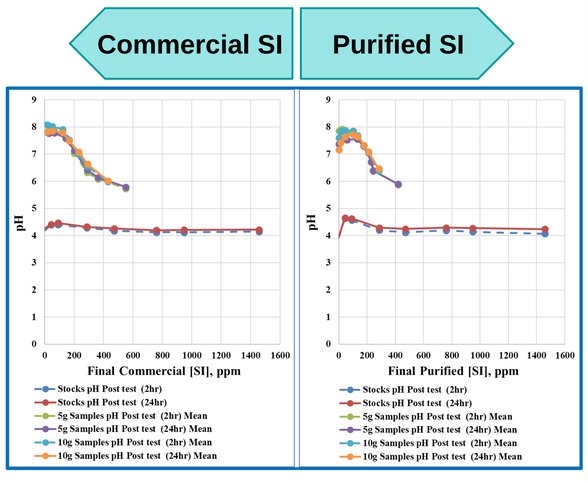
- For the commercial and purified DETPMP, the apparent adsorption levels reach a high of 7 and 8 (mg SI/g substrate) for $[SI]_f$ of 550ppm and 450ppm, respectively.
- Coupled adsorption/precipitation obvious for both SIs
- Purified DETPMP showed a higher level of apparent adsorption
- Lower adsorption of commercial SI may be related to the presence of ~10% impurities. Impurities (phosphorus-containing acids and compounds) do not influence adsorption

Commercial SI | **Purified SI**





Commercial SI | **Purified SI**



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