

SURFACTANT ACID RETARDER



Create Greater Wormhole Complexity with Controlled Acid Reaction

Background

In oilfield operations, acidizing is a crucial technique used to enhance oil and gas flow by dissolving carbonate formations like limestone and dolomite. In low permeability, high temperature reservoirs, efficient stimulation is governed by reaction kinetics versus placement time for the treatment solution. Hydrochloric acid (HCl) is the primary agent used for this process, but it reacts too quickly, and gets consumed in the near wellbore area, limiting its ability to penetrate deeper into the reservoir. This premature acid spending can reduce the effectiveness of the treatment, preventing optimal well stimulation and leaving untapped potential within the formation.

To maximize efficiency, a controlled acid reaction is essential—allowing deeper acid penetration before spending occurs, improving reservoir connectivity, and enhancing overall production.

Why Choose PETROSTEP® SAR-1?

PETROSTEP® SAR-1 stands out from conventional acid retardation systems due to its superior performance, cost-effectiveness, and enhanced ESG profile compared to emulsified acid systems based on hazardous solvents. Unlike polymer or viscoelastic surfactant-based gelled acids, PETROSTEP® SAR-1 provides consistent acid retardation without the risk of unbroken gel or polymer residue.

- **Safer Handling:** Aqueous-based formulation eliminates the need for flammable solvents, reducing operational hazards.

KEY BENEFITS

- 1 Improves well stimulation efficiency by enabling deeper acid penetration prior to acid spending.
- 2 Reduces formation damage risk compared to polymer-based retardation methods.
- 3 ESG-friendly alternative to solvent-based emulsified acids.
- 4 Single-phase aqueous formulation simplifies handling and logistics.

- **Enhanced Wormhole Generation:** The delayed acid reaction allows for deeper acid penetration before spending.
- **Cost-Effective Performance:** Product loading can be adjusted to optimize carbonate dissolution time, maximizing efficiency while minimizing over-treatment.
- **Compatibility & Stability:** Stable in concentrated HCl (7%- 28%), and compatible with standard acidizing additives.

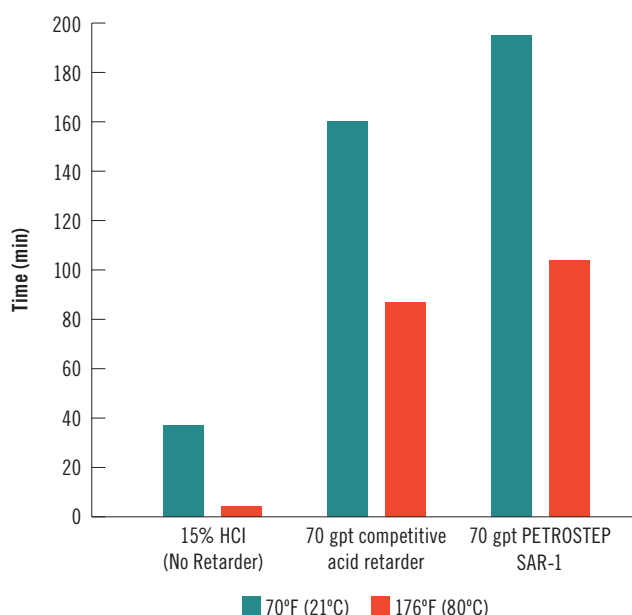
Applications

- Carbonate acidizing with 15–28% HCl formulations.
- Suitable for batch and continuous acidizing operations in oilfield applications.
- Works in high-temperature and low-temperature environments, offering consistent retardation performance.

Performance Testing & Validation

PETROSTEP® SAR-1 has been tested against competitive acid retarders in a controlled reaction study using 15% HCl and carbonate rock. The results below demonstrate its effectiveness in slowing acid reactivity, allowing for prolonged acid action in the formation.

TIME TO DISSOLVE KNOWN MASS OF MARBLE IN 15% HCl AT 70 AND 176°F (21 AND 80°C)



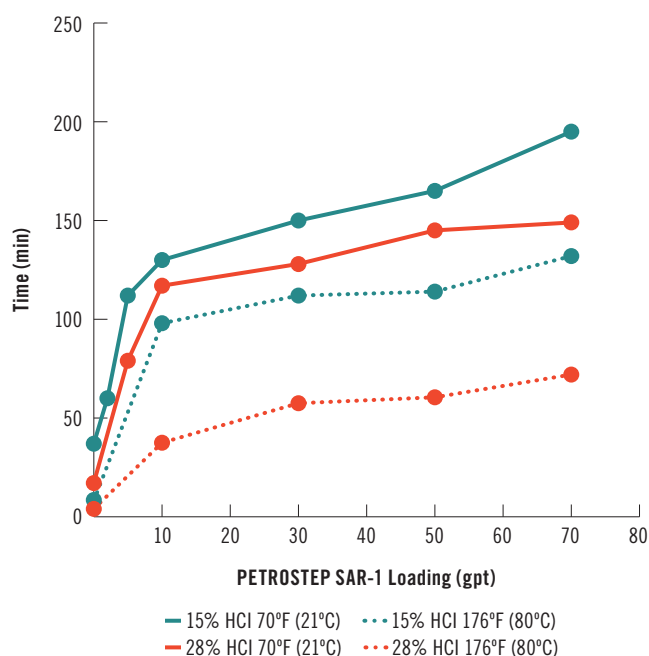
*GPT = gallons per 1,000 gallons

TYPICAL PROPERTIES

Appearance	Clear liquid
Freezing Point, °F (°C)	< 41 (< 5)
Flash Point, PMCC, °F (°C)	> 201 (> 93.9)
Density, lb/gal (g/mL)	8.5 (1.01)
Typical pH Range	~ 6 (as is)

Testing shows that above 10 gpt*, increasing PETROSTEP® SAR-1 loading results in an approximately linear increase in acid retardation, providing tunable acid consumption rates for various well temperatures and acid strengths.

EFFECT OF PETROSTEP SAR-1 LOADING ON MARBLE DISSOLUTION TIME



Safety Precautions: Refer to safety data sheets (SDS) for handling, transport, environmental information, and first aid.

For more information about PETROSTEP SAR-1 and other PETROSTEP products, email oilfield@stepan.com or call 713.955.8100.

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