



CSES-5000 SERIES

TECHNICAL DATA SHEET

PRODUCT DESCRIPTION: EOR TREATMENT

CSES-5000 is a buffered polymer-surfactant-silicate-based solution specifically designed for Enhance Oil Recovery (EOR). It is manufactured through a proprietary process which impacts better reactivity and performance than conventional products for overcoming tougher production problems. It helps reduce interfacial tension and hardness ion concentrations thereby increasing oil mobility. It is also designed to promote greater diffusion into the formation to release more oil. This ultimately leads to the reduction of concentration requirements for other polymers and surfactants additives improving yields and profits. Finally, the products are water-based, non-toxic, non-flammable and environmentally safe (in RTU form).

HOW IT WORKS

CSES-5000 works in four ways:

1. *Improving surfactant efficiency through the removal of hardness ions from reservoir brines thus reducing adsorption of surfactants on rock surfaces.* By binding or precipitating hardness ions, it causes a more favorable oil release from the reservoir by preventing oils from binding to metals or clay and prevents surfactants from adsorbing to the formation. While silicate based, CSES-5000 does not introduce any significant amounts of silicate to cause scaling problems.
2. *Modifying viscosity to increase diffusion into the formation:* CSES-5000 contains a water soluble polymer that remains fluid at alkaline pH. As the alkaline component is consumed and the pH drops, the viscosity of the polymer increases forcing the remaining solution to find another way through the formation. This forces the product deeper into the formation allowing the other components of CSES-5000 to release more trapped oil. This degradable polymer eventually breaks down reopening the main channels for oil flow and allowing more oil to be recovered.
3. *Buffering the system to maintain an optimal pH over a wide range of concentrations.* A very significant factor that determines whether a scale forms is the pH value of the system. Factors such as temperature, pressure, ionic make-up and other less variables also play some roles but it is the pH that determines which solids phases form scale or precipitate to alter productivity. A buffered system helps minimize the interfacial tension within the formation thereby allowing better oil flow and recovery. It also helps to in controlling hardness ions in the formation, lessens formation damage, and results in less scale formation. Because high alkaline materials typically used react with the rock minerals and formation water, they dissolve native rock causing formation damage and increasing the concentration of scaling ions (Ca^{+2} , CO_3^{-2} , SiO_4^{-4} which when they precipitate cause problems. (Note: most silicate in scale come from the formation that was dissolved by the high alkaline conditions in traditional alkaline flooding fluids. Others have shown that the silicate precipitation is probably nucleated by calcium carbonate formation). All these equilibrium reactions show very high sensitivity to pH and tend to be accelerated by the presence of hydroxide forming metals e.g., Fe^{2+} , Mg^{2+} or Al^{3+} . Maintaining a stable pH is very beneficial for better controlling the enhanced oil recovery process.
4. *Converts carboxylic acids and phenolic acids into powerful surfactants to lower interfacial tension.* Crude petroleum is known to contain varying amounts for organic acid materials (e.g. carboxylic acids and phenolic acids) that can react with alkaline materials to form soaps. These soaps reduce the interfacial tension between the crude petroleum and water. This reduction in interfacial tension enables solutions to more easily displace residual oil from the pore of a

reservoir. CSES-5000 possess a high hydroxide capacity that maximizes saponification potential in converting endogenous carboxylic acids and phenolic acids into surfactants that enhance oil emulsification and mobility.

APPLICATIONS

Treatment of Oil & Gas Wells

- Determine the well output. Based on this output, the amount of finished (RTU, Ready-To-Use) product required would be 84 gallons per 100 barrels (2% of volume) of production.
- The amount of product concentrate would be 1/10 of the amount determined above. Or in other words, the concentrate needs to be diluted 10:1 to make the RTU product. Based on this dilution and dosage outlined in #1, you would need 8.4 gallons of concentrate per 100 bbls.
- In order to dilute the product, it is recommended that brine, KCl or Calcium Chloride water be used. The minimum density of the brine water should be heavier than the produced water.
- Pump entire solution volume down the well. Allow to sit for 24 hours, circulate for 24 hours then place well back on line.
- The product can also be fed continuously. The dosage for continuous feed is a 1% RTU solution.

Treatment of Water-Based Drilling Muds in Heavy Oil Fields.

- For Lab Test/Demo, Calculate the amount of water in the drilling mud.
- Add the product at a rate of 10% of the water volume. Ignore volume of non-water components.
- Heat Sample to 125°F.
- Shake well. It can cool and the sample will retain properties.
- Field Application is the same application but temperature generation and mixing is provided once drilling mud is circulated down hole.

Treatment of Slop Oil

- Product, as supplied, is a concentrate and should be diluted 10:1 (up to 30:1) to make the RTU (ready-to-use) application version. Use salt or brine water that is heavier than the produced water.
- Product is fed to tank bottom or sludge at a rate up to 25% based on total volume.
- Add and provide mixing without “shearing” the solution

Heavy Oil Tank Sludge Handling and Waste Minimization.

- Product, as supplied, is a concentrate and should be diluted 10:1 (up to 30:1) to make the RTU (ready-to-use) application version. Use salt or brine water that is heavier than the produced water.
- Product solution (RTU) is fed to tank bottom or sludge at a rate up to 25% based on total volume.
- Add and provide mixing without “shearing” the solution.

Other Applications

- **Tar Sands Processing:** Product and process dramatically enhances production and eliminates Tailings.
- **Mature Fine Tailings (MFT) Processing:** Product breaks the emulsion into clay, water and recoverable bitumen
- **Pipeline Transport:** Product creates a colloidal suspension which reduces drag and dynamic viscosity

TYPICAL PHYSICAL PROPERTIES

Appearance.....	Clear to slightly brown with chemical odor
pH Neat.....	>12
pH RTU.....	7-8
Specific Gravity.....	1.01
Boiling Point.....	> 210°F
Freezing Point.....	30°F