



Stepan 
OILFIELD SOLUTIONS

PETROSTEP[®] IFT LOWERING AGENTS

Flowback Aids for Hydraulic Fracturing

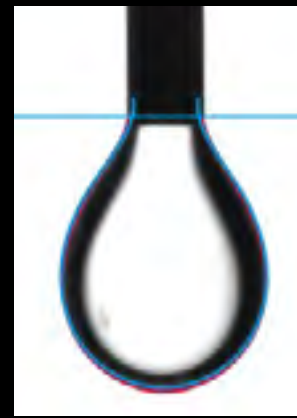
Stepan Oilfield Solutions' PETROSTEP C-1, PETROSTEP S-2, and PETROSTEP S-13C HA help hydraulic fracturing companies improve oil and gas recovery and enhance flowback by lowering interfacial tension (IFT) between injected fluids and the hydrocarbons.

When in the presence of decane, PETROSTEP C-1 and PETROSTEP S-2 can moderately reduce IFT to be in the range of 1 – 10 dyne/cm at 25°C (see Figure 1), and PETROSTEP S-13C HA can greatly reduce IFT to less than 0.1 dyne/cm at 25°C (see Figure 2). By lowering IFT, these surfactants can alleviate phase trapping. This can allow stimulation fluids to flow back more quickly, and potentially increase the flow of oil and gas from the reservoir.

The table below shows the resulting IFT for 2 gallons per thousand (gpt) of PETROSTEP C-1, PETROSTEP S-2 and PETROSTEP S-13C HA in 2% by weight potassium chloride (KCl) solution.

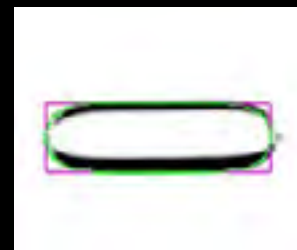
SURFACTANT	IFT (DYNE/CM)
PETROSTEP C-1	4.43
PETROSTEP S-2	1.08
PETROSTEP S-13C HA	0.06

FIGURE 1



2 gpt PETROSTEP C-1 in 2% KCl, tested using the pendant drop method.

FIGURE 2



2 gpt PETROSTEP S-13C HA in 2% KCl, tested using the spinning drop method.

PRODUCT PROPERTIES AND APPLICATION RECOMMENDATIONS

TYPICAL PROPERTIES

- Appearance at 25°C
 - PETROSTEP C-1: clear liquid
 - PETROSTEP S-2: clear, pale amber liquid
 - PETROSTEP S-13C HA: light to dark amber liquid
- Fully dilutable

APPLICATION

Flowback aid for hydraulic fracturing

- Surface tension: <30 dyne/cm
- Interfacial tension vs decane: <10 dyne/cm

RECOMMENDED TREATMENT RATE

1 to 3 gallons per thousand gallons of fracturing fluid

For more information about PETROSTEP products, email oilfield@stepan.com or call 713.955.8100.