Protocol300i: Evaluation as a Foaming Agent for Gas-Condensate Well Applications

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Challenges in Gas-Condensate Well Operation

Problem of Liquid Loading

As reservoir pressure declines in gas wells, liquids start to accumulate, hindering gas flow and reducing production rates

Insufficient Flow Velocity

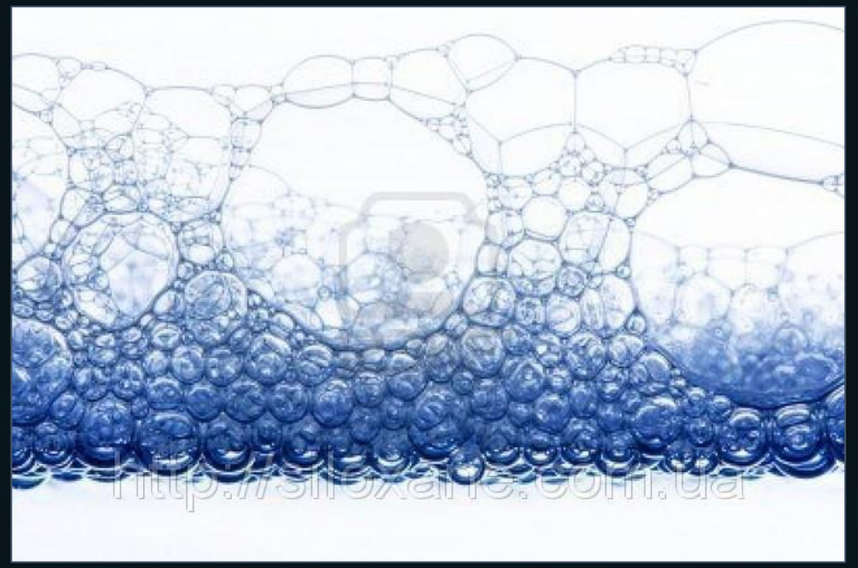
At lower pressures, gas flow velocity is not enough to effectively carry water and condensate to the surface

Objective of the Study: To stabilize well operation and enhance hydrocarbon recovery by removing accumulated liquids through controlled dosing of foaming agents

Foam-Lift Method Overview

Principle of Action

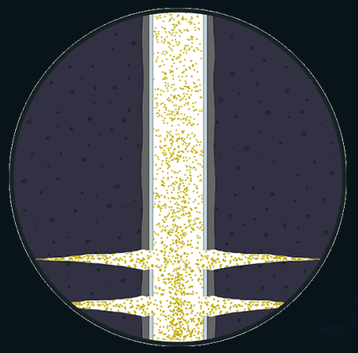
When surfactant (Foaming Agent) is injected into the well and gas passes through the solution, foam is generated — a dispersed system of gas bubbles separated by liquid films.

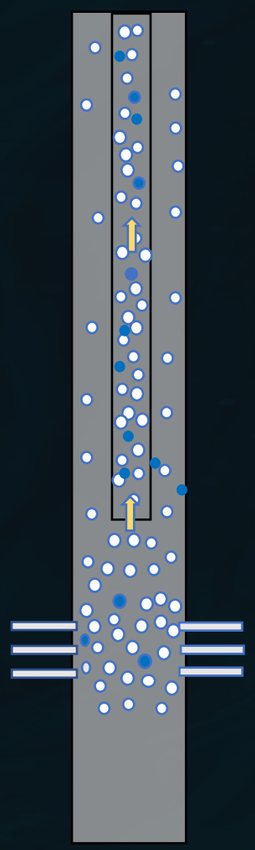


Foam Advantages

- Specific gravity several times lower than water
- Large effective surface area
- Reduced gas slippage
- Efficient liquid lifting even at low production rates

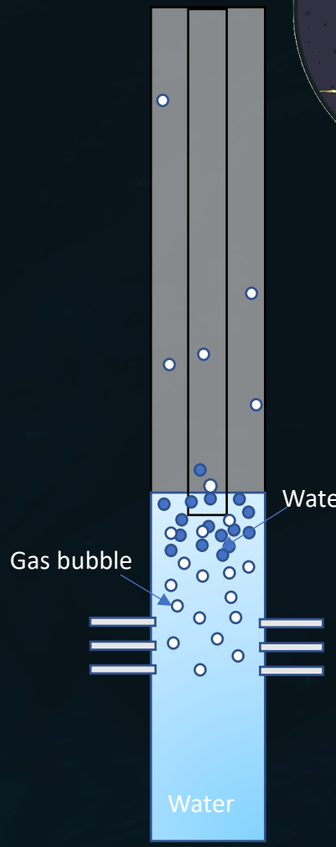
Foam Formation Mechanism





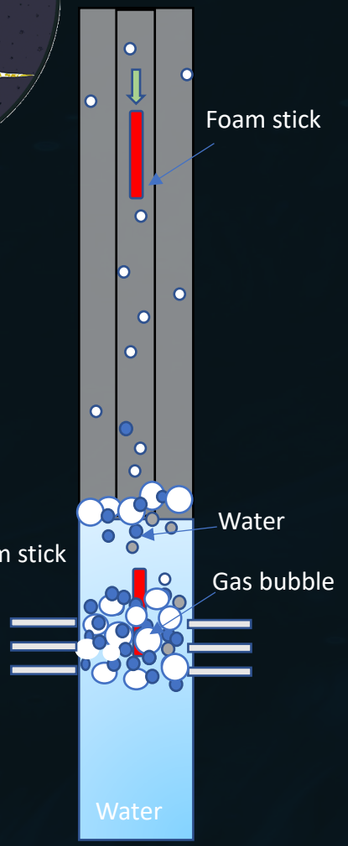
$V_g > V_c$

Gas velocity > Critical velocity



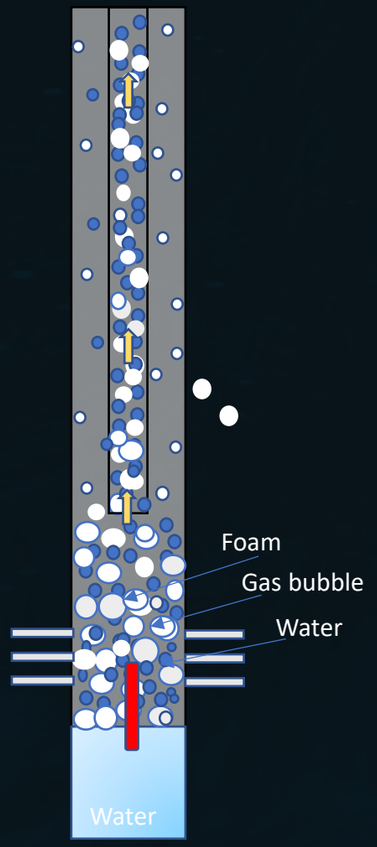
$V_g < V_c$

Gas velocity < Critical velocity



$V_{c1} < V_c$ ($\sigma_1 < \sigma$)

Gas velocity above modified critical velocity (surface tension reduced)



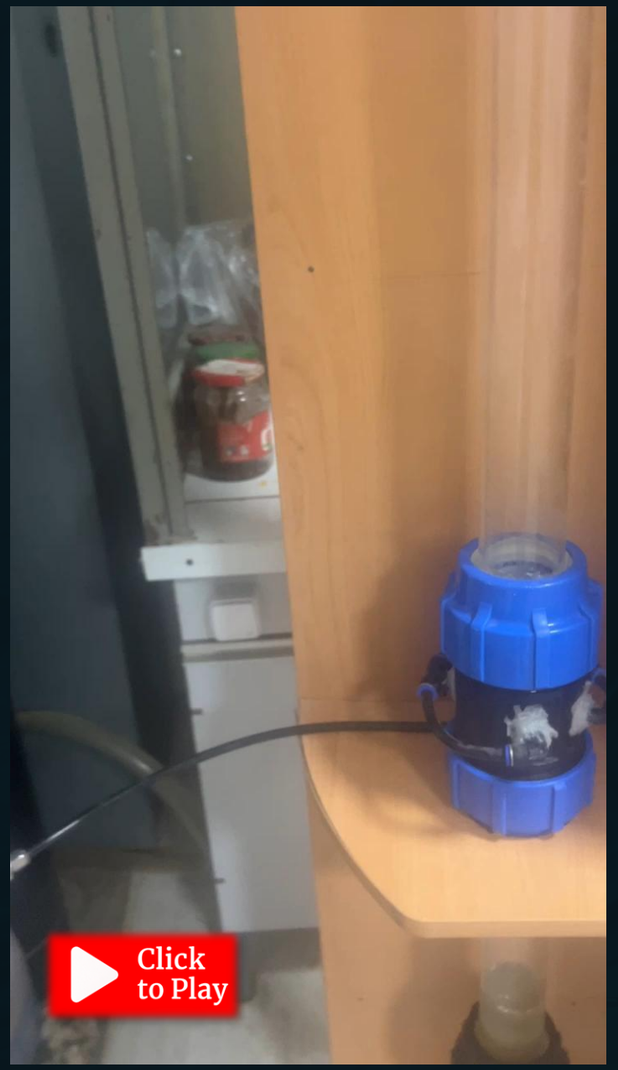
$V_g > V_{c1}$

$V_g < V_c$

Gas velocity between modified and original critical velocity

Foam generation in gas wells: mechanism of liquid lifting

Foaming Performance Test



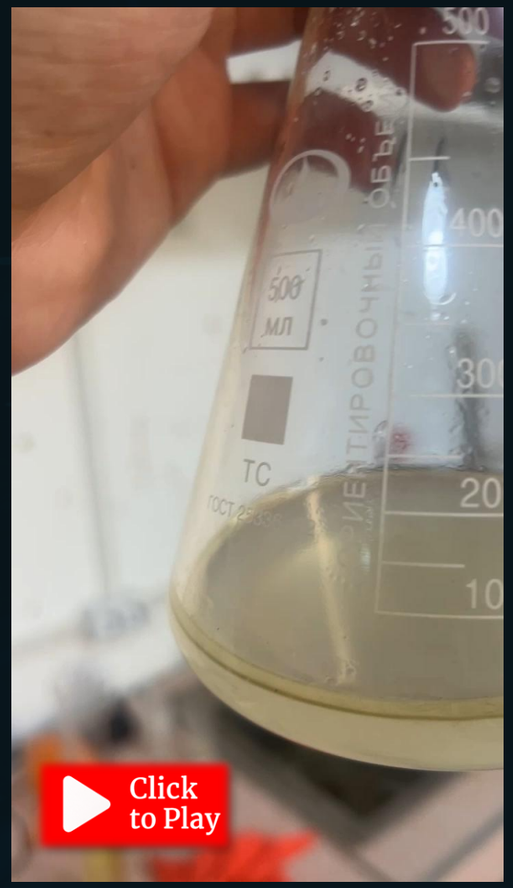
Foaming of formation water

Altachem sticks, 0.5% wt.

Foaming of formation water

Protocol300i, 3% vol.

Performance of Protocol300i in Gas-Condensate Systems



Test with 10% Condensate

Protocol300i, 3% vol. concentration
Stable foam generation.

Test Result

No emulsion formation – a key positive factor for field application

Protocol300i shows strong foaming performance and no emulsion issues, confirming suitability for gas-condensate wells

Research Findings

Protocol300i Efficiency

Protocol300i demonstrates excellent foaming performance, ensuring effective liquid lifting and stable operation in gas and gas-condensate wells.

Need for Further Research

The results confirm Protocol300i’s strong potential as a replacement for conventional foaming agents, opening new possibilities for enhanced gas recovery and well productivity improvement.

Further research is recommended to refine optimal concentrations and validate performance under various reservoir conditions.