Enhancing CSG well production via foam assisted lift method

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Introduction

Production of coal seam gas (CSG) reservoirs is associated with producing a significant amount of water that needs to be removed to allow gas to be produced.

Currently artificial lift systems such as downhole pumps are used to dewater these wells. These downhole pumps are prone to failure from gas interference and fines production, resulting in high downtime and maintenance costs.

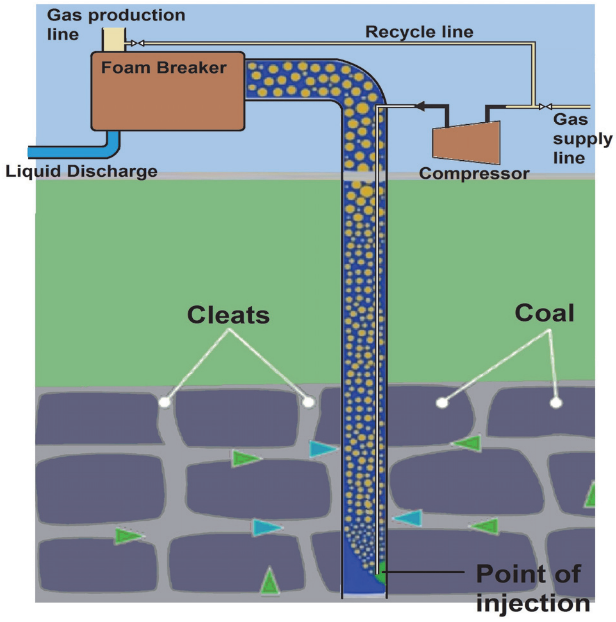
In this research, we aim to develop foam-assisted gas lift to dewater CSG wells. The proposed dewatering system allows us to control and minimise the flowing bottom hole pressure (FBHP) through the fluid density.

The proposed solution provides other advantages such as:

(a) Transport of fine solids out of the well.

(b) No downhole moving parts.

(c) Allowing the whole well cross-sectional area to be used for production. Consequently, smaller wellbore sizes may be used for production, saving drilling and casing costs.



Methodology and Apparatus

A 50mm wide x 8m long pipe is fabricated and designed to simulate the three-phase gas-liquid-solid foam flow, that can be operated under a controlled pressure (up to 8 bar).

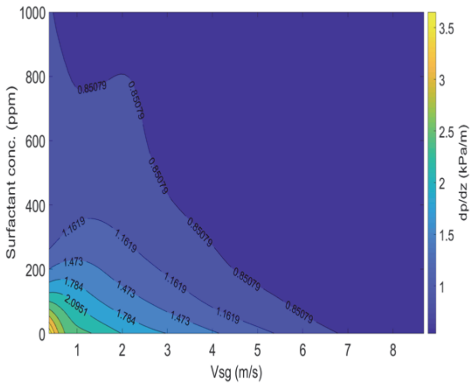
- The main aim is to transport gas, liquid and solids in a controlled fashion. This includes the ability of the foam to lift particles, dewater the well and advance the free flow.
- Multi-injection points are considered for both water and gas inflow to investigate the complexity of the flow at the bottom of the well.

Flow regimes, foam stability, physical characteristics and lift capacity are to be investigated. This will be done at different surfactant, particle and salinity concentrations, under a range of operational conditions.

Contribution of surfactant:

An industrial surfactant (SCI-FOAM, supplied by Nalco Champion) was used.

It was found that formation of foam under an optimum surfactant concentration can potentially provide a pressure gradient less than 0.7 kPa/m in a specific gas rate range.

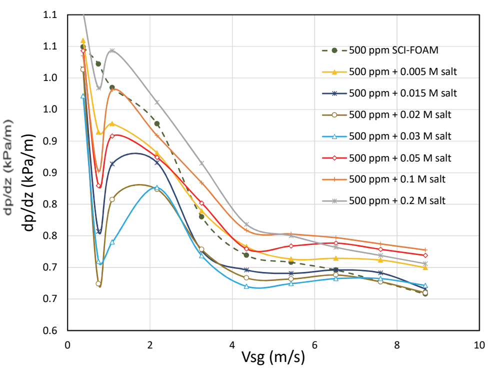


Pressure gradient at fixed 2 L/min water flow rate

Contribution of salt:

A range of natural salinities - mainly sodium chloride (NaCl) from 0.005 to 0.2M was tested.

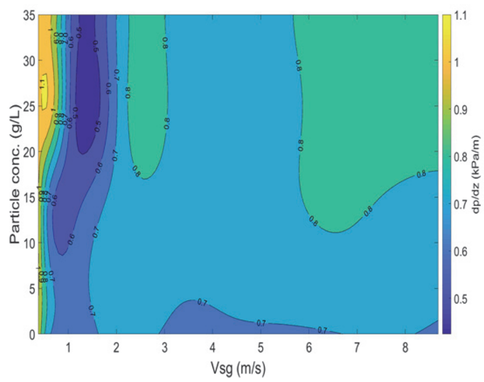
It was found that the presence of salt (below 0.1M) improves the foaminess of the solution leading to further reduction of pressure gradient, especially at lower gas flow rates (V_{sg} < 2.2 m/s).



Pressure gradient vs gas velocity at fixed 2 L/min water flow rate containing 500 ppm surfactant

Contribution of particles:

The results of simultaneous presence of salt and particle in a surfactant solution show that particles have an insignificant impact on the pressure gradient of the flow, while they increase the stability of the foam generated and increase the lifting capacity of the water.



Pressure gradient at fixed 2 L/min water flow rate containing 1000 ppm surfactant

Acknowledgements

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