Development and Evaluation of a High Temperature and Condensate Tolerant Foamer

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High Temperature and Condensate Foamer

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1. Introduction
   - Foamer as a gas well deliquification technique
   - Market demand

2. Evaluating New Foamers
   - Determining thermal stability of a product

3. Highlight of Case Histories
   - Success with continuous treatments
   - Success with batch treatments

4. Conclusions
Foamers are Surfactants

- Foamers are surfactant based products
- Prefer to reside at the interface
- Alter surface tension and wetability
  → Form foams and reduce density of fluids

[Diagram: Foam structure with hydrophilic head and hydrophobic tail]
How Foamers Unload Fluids

- **Loaded well**
- Foamer added & shut in 24~48hrs
- **Fluids unloaded**

Decreasing surface tension of fluids

→ Foam forms & density of fluids decreases
→ Fluids are unloaded & gas production increases
Market Demand for High Temperature Foamers

- As well depth increases, bottom hole temperature increases.

- The majority of existing products perform best at 250~300°F in the absence of condensate. However, the performance is relatively poor in the presence of condensate.

- Emerging market for high temperature and condensate tolerant foamers.
Evaluating New Foamers

- Significance of Determining Thermal Stability of a Product
  - Ensure that foamers would work under bottom hole conditions
  - Ensure that foamers would not plug up capillary
Experimental Test Procedure

1. Conduct thermal aging tests of experimental foamers at 250 - 400 °F.

2. Identify the foamers pass thermal aging tests at least at 275°F.

3. Test the foamer performance in synthetic fluids and identify out-performing foamers.

4. Evaluate the performance of the foamers in field fluids and select foamer that had better cost performance than existing products.

5. Formulate winterized products, combination products.
Thermal Aging Tests

- Foamers hydrolyze at high temperature
- Appearance of homogeneity does not guarantee product performance
Performance Tests of Thermally Aged Foamers

- New foamer and Product A passed thermal aging test at 300°F, but none of them unloaded fluids.
- However, aged foamers at 275°F gave performance comparable to non-aged foamers.
Cotton Valley Wells in East Texas

- Success with Continuous Treatment
- Success with Batch Treatment
Gas Production Increased 32%

- The foamer was applied via continuous treatment, dosage of ~ 0.2%
- Average gas production increased from 187 mscf/d to 247 mscf/d
- Incremental gas revenue was $651*/ day or $ 10,416 total
  * Market price was 7.40/mscf when the field trial was conducted
Gas Production Increased 5-fold

- The foamer was applied via continuous treatment
- Average gas production from 100 mscf/d to 504 mscf/d, 5-fold increment
- Incremental gas revenue was $2,316*/ day or $13,899 total
  - * Market price was 5.65/mscf when the field trial was conducted
Gas Production Increased 15%

- The foamer was applied via batch treatment, dosage of ~2%
- Average gas production from 350 mscf/d to 402 mscf/d
- Incremental gas revenue was $384/day or $5,395* total
  
  * Market price was 7.40/mscf when the field trial was conducted
Gas Production Increased 22%

- The foamer was applied via batch treatment, dosage of ~0.3%
- Average gas production from 116 mscf/d to 146 mscf/d
- Incremental gas revenue was $262/day or $3,670* total
  * Market price was 7.40/mscf when the field trial was conducted
Conclusions

1. Foamers unload fluids from a well by reducing density of fluids.

2. There is a market demand for high temperature and condensate tolerant foamers.

3. Thermal stability of products needs to be determined by evaluating aged products.

4. New foamer was applied via batch treatment and continuous treatments. The foamer increased gas production significantly resulting in increased revenue.
Questions?
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