Recent application and successes of the novel foamer for deliquification of condensate loaded wells

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Overview

• Methods for Unloading Liquids in Gas Wells
• Challenges of Conventional Foamers
• Condensate Foamer Development
  – Foam Column Apparatus
  – Well Condensate Comparison
  – Water Cut Effect
• Field Tests
  – Selecting Successful Candidates Wells
  – Recent and Current Field Tests
Recent application and successes of the novel foamer for deliquification of condensate loaded wells

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Methods for Unloading Liquids in Gas Wells

• Mechanical
  – Gas Lift
  – Plunger Lift
  – Rod Pump
  – ESP (Electrical Submersible Pump)
  – PCP (Progressive Cavity Pump)
  – Intermittent Production (timers)
  – Additional Compressors (lower wellhead pressure)

• Chemical
  – Foamers
Theoretical Approach

- Lower density of the droplet
- Reduce surface tension and make smaller droplets

Magnified Entrained Liquid Drop

Fluids

Gas Flow

Fluids and Foamer

Gas Flow

Magnified Entrained Foam Drop
Challenges for Conventional Foamers

- High condensate cut acts as foam suppressant
- Higher concentration can have adverse impact on downstream processes
- Conventional foamers are ineffective in 100% condensate
Condensate Foamer Properties

- Targeted to treat wells with 60% or more condensate
- Effective even at 100% condensate
- Thermostable and capillary approved at 400 ºF
- Pour point (-40) ºF
Foam Column Testing Apparatus

- Water circulator
- Gas supply
- Flow meter
- Test column
- Foam
- Balance
Condensate Foamer Exhibited a Broader Effectiveness Range

80% Condensate - 1% Various Foamers

% Unloaded

Well A  Well B  Well C  Well D  Well E  Well F

Condensate foamer  Amphoteric foamer  Anionic foamer
Foaming Performance Increases with Condensate Cut

Condensate Cut Effect - 1% Condensate Foamer

- **Well A**
- **Well C**
- **Well D**
- **Well F**

Wt % Unloaded vs. % Condensate
Field Test Approach

- Candidate Well Selection
  - Production profile evaluation
  - Flow modeling
  - On-site (or lab) screening with field fluids to evaluate wells
- Initiation of trial
- Monitoring of production data
- Performance evaluation
- Optimization
Flow Modeling

- Identifies wells with sufficient energy potential to unload liquids
- Identifies where loading occurs (produced or condensed fluids)
- Captures critical characteristics of the well to ensure proper product is used (conventional vs condensate foamer)
Production Profile Evaluation

- Identifies the well’s baseline
- Identifies the critical velocity where loading occurs
- Illustrates the well’s loading/unloading behavior
- Enables visualization of gas production trend
Case History One – Major Operator

Field Information
• Middle East
• Well 1: 58 % condensate, sustained production
• Well 2: 50 % condensate, intermitter production

Foamer Application
• Continuous injection down the annulus
• Initial injection rates were 60 gpd on each well
• After 3 days rates were optimized to 15 gpd on each well
Case History One – Major Operator

Results

• Well 1: Production increased from 4.0 MMSCFD to 5.5 MMSCFD for the first 12 days, and dropped to 5.0 MMSCFD thereafter.

• Well 2: Production increased by 45% and the shut in period reduced from 4 days to 1 day.
Results: Well 1

- Gas Price: $7.84/MMBtu (at the time of the trial)
- Increased in revenue by $11,760/day for the first 12 days and $7,840 thereafter
Results: Well 2

![Graph showing injection rate and production for Well 2 from May 18, 2007 to October 5, 2007. The graph indicates fluctuations in injection rate and production over the period, with notable peaks and troughs. The x-axis represents dates from May 18, 2007 to October 5, 2007, and the y-axis represents injection rate (gpd) and production (MMSCFD). The graph also includes a legend indicating the difference between FMO6000 and production.]
Case History Two

Field Information

- Wyoming
- Well 3
- 80% condensate
- Paraffin problems
- Shut In- dead well
Case History Two

Foamer Application
• Batch treatment
• 2.5 gallons once a week

Results
• Production revived to 300 MSCFD and 75 BOD
Revenue Increased by More than $9,000/day

Gas Price: $7.84/MMBtu (at the time of the trial)
Crude Price: $90/bbl (at the time of the trial)
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Comments & Questions?
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