Elemental Analysis of FLO® Drag Reducer Products

Crude Oil Quality Group Meeting
September 29, 2005
Additives in Crude

• Trace contaminants in the crude feed to refineries can cause many problems

• Specific recent focus on calcium and silicon

• Additives are a potential source of such contaminants
  – Corrosion inhibitors, pour point depressants, demulsifiers, paraffin inhibitors, hydrogen sulfide scavengers, etc.
Preview

• Brief drag reduction overview
• Composition of drag reducer products
• Elemental analysis of FLO® products
• Summary
DRA’s inhibit the formation of turbulent bursts within the pipeline. By helping organize turbulent flow streamlines, DRA’s reduce hydraulic friction pressure loss (drag).
Benefits of *FLO®* Pipeline Booster

- Increase profitability via increased throughput, bypassing intermediate pump stations
- Eliminate capital spending - removes the need for extra pumps, pump station, and loops
- Enhance pipeline operation safety
- Allows for improved scheduled maintenance
Typical Dosages Used

• Assume injection of 100 ppm of any additive into a crude line
  – If the additive contains a 10 ppm level of X, concentration of X in the crude increases by 1 ppb

• For crude pipelines, typical DRA dosages are 25-100 ppm/pump station
  – For most crude lines, DRA is injected at 1-2 pump stations
Composition of Drag Reducer Products

• Commercial drag reducers for crude pipelines contain:
  
  – High molecular weight hydrocarbon polymer
    • This is the active ingredient, typically a poly-olefin
  
  – Carrier solvent(s)
    • Typical examples include simple hydrocarbon solvents, ethers, alcohols, water
  
  – Stabilizers (anti-agglomeration agents, suspension agents, etc.)
    • These can be organic or inorganic
FLO® Drag Reducers

• FLO® product line consists of 2 product “families”
  – Gel products
    • FLO® 1010, FLO® 1020, FLO® XS
      – All are >99% organic (C/H/N/O)
  – Slurry products
    • FLO® XL
      – >93% organic
    • FLO® MX
      – >99% organic
## FLO® Product Elemental Analysis

Testing via ICP analysis, all levels in parts per million (ppm).

<table>
<thead>
<tr>
<th>Product</th>
<th>Cr</th>
<th>Pb</th>
<th>Ni</th>
<th>Sr</th>
<th>Si</th>
<th>S*</th>
<th>V</th>
<th>Sn</th>
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<td>FLO® 1020</td>
<td>&lt;0.4</td>
<td>&lt;0.4</td>
<td>&lt;0.4</td>
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<th>Na</th>
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<th>Mo</th>
<th>Cu</th>
<th>Zn</th>
<th>Ba</th>
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*ASTM D 7039-04 (X-Ray Fluorescence) used for sulfur level determination

D. Schwartz  
September 2005
Summary

• All FLO® drag reduction products are >93% organic, with most being >99% organic.

• Elemental analysis shows many inorganic elements present at <0.4ppm (test detection limit)

• All FLO® products: Si: <60 ppm; Ca: <200 ppm; S: <4ppm

• Based on these results, and historical experience, FLO® products are expected to have a negligible impact on refinery operations
Thanks!!
Questions??