Exploiting Opportunities with Challenging Crudes

Presented to: COQA, 7th March 2013
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Types of Challenging Crudes

Source: PTQ
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Feedstock Constraints

- Low Gravity/ High Viscosity
- High Pour Point
- High Nitrogen
- High Solids
- High Metals
- High TAN

<table>
<thead>
<tr>
<th>Example high pour point crudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude</td>
</tr>
<tr>
<td>Mandji</td>
</tr>
<tr>
<td>Oguendgo</td>
</tr>
<tr>
<td>Zeit Bay</td>
</tr>
<tr>
<td>Congo Export Blend</td>
</tr>
<tr>
<td>Nile Blend</td>
</tr>
<tr>
<td>Darr</td>
</tr>
</tbody>
</table>

Effect of various solid particles on the type and stability of emulsions

<table>
<thead>
<tr>
<th>Solids</th>
<th>Bentonite</th>
<th>Organo-philic clay</th>
<th>Kaolinite</th>
<th>Calcium carbonate</th>
<th>Barite</th>
<th>Water-wet silica</th>
<th>Oil-wet silica</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume, ml</td>
<td>14.6</td>
<td>15.0</td>
<td>13.4</td>
<td>11.9</td>
<td>11.3</td>
<td>11.0</td>
<td>10.7</td>
</tr>
<tr>
<td>Type of emulsion</td>
<td>O/W</td>
<td>W/O</td>
<td>O/W</td>
<td>O/W</td>
<td>O/W</td>
<td>O/W</td>
<td>W/O</td>
</tr>
<tr>
<td>Major size</td>
<td>0.1-8</td>
<td>0.1-8</td>
<td>2-18</td>
<td>6-10</td>
<td>6-25</td>
<td>8-15</td>
<td>8-15</td>
</tr>
<tr>
<td>range, μm</td>
<td>Platelets</td>
<td>Platelets</td>
<td>Platelets</td>
<td>Approx. spherical</td>
<td>Approx. spherical</td>
<td>Approx. spherical</td>
<td>Approx. spherical</td>
</tr>
<tr>
<td>Shape</td>
<td>Platelets</td>
<td>Platelets</td>
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Source: Yan, Wang, Jiang, Fan, & Su, 1997
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Opportunity No. 1: Increase in Residuum Processing

- European Refinery: 70% Crude + 30% Residuum
- Poor desalting, catalyst degradation downstream, coking
- High metals in residuum
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**Vicious Cycle**

- High Residuum Processing
- Increased load on Downstream Units
- Inefficient stripping
- Increased load on stripper
- High pH of Desalter wash water
- Inefficient Desalting
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Vicious Cycle

1. High Residuum Processing
2. Increased load on Downstream Units
3. Inefficient stripping
4. Low pH of Desalter wash water after treatment
5. Improved Desalting

Add pH Modifier Agent at this step
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Opportunity 2: Impact of Oilfield Chemical Treatment on Feedstock and Unit Operations

- Refinery processing Merey-16 crude (Orinoco region)
- Often treated with Calcium Hydroxide in Oilfield = calcium naphthenates formed
- Impurities in Desalter
- Accumulate in Trilines

![Element detected in triline, %](chart.png)
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**Requirement of Metals Removal Additive**

- Additive required to reduce downstream effects of calcium
- Other additives cannot perform well in presence of H2S (black pad formed in brine)
- Results in relatively easy processing of difficult crude
Opportunity 3: High TAN Crude processing under sweet conditions

- High TAN crude processing is ideally coupled with high sulfur crudes
- In South America, ample high TAN crudes and sweet crudes
- Refineries rarely invest in complete metallurgy upgrades hence additives are required
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High Temperature Corrosion Methodology

- Corrosion Cell in given
- Benefits of sulfur in feed is contribution to some extent of protective layer
- New Formulation Product:

<table>
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<tr>
<th>Organo Phosphorus-Sulfur</th>
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<td>Contains phosphorus &amp; sulfur: Low Phosphorus</td>
</tr>
</tbody>
</table>

Diagram:
- Corrosion products: R-SH, H₂S (RD₃₀₀)₂, FE (FeS)₉
- Naphthenic acids
- Reactive sulphur
- ROOH
- R-S-R
- Scale
- Fe
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