Oil in Water Analyser Utilization Experience

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Advanced Sensors : Khalid Thabeth
The Challenges

• Fouling
• Chemical Interference
• Analyser & Lab Correlation
• Selecting an Analyser - Guidelines
Fouling

The fouling of the sensor window/s affects all optically based analysers.

**Talisman** use of analysers have suffered from a fouling on a variety of sensor’s windows. Noticeable effects in less than 1 hour.
An EX1000 was installed September 2005.
Zero cleaning required following 24 months of service to-date.

**Chevron** use of analysers have suffered from “schmoo” (iron sulfate) build up on a variety of sensor’s windows.
Noticeable deposits in hours.
Two EX1000’s installed in December 2006.
Zero cleaning required following 22 months of service to-date.

**StatoilHydro** use of analysers have suffered from Heavy soft scale build up on a variety of sensor’s windows.
Noticeable deposits in hours.
EX1000’s installed January and July 2007.
Zero cleaning required following 21 months of service to-date.
Oil Droplet Size Variation

• Oil Droplet size variation directly affects the level of fluorescence and unchecked directly affects the resulting ppm measurement.

• In many applications Oil droplet size variation is minimal and has negligible affect.

• Where oil droplet size varies significantly, the affect on PPM reading is drastic unless the analyser can control oil droplet size or adjust accordingly.

• The EX100 and EX1000 periodically uses ultrasonic's to break down the oil droplets to a standard size, so the analyser automatically compensates for the variation in droplet size. There is no requirement for mixers or Surfactants to reduce oil droplet size.
Fouling & Oil Droplet Size Adjustment
Ultrasonic Cleaning and Homogenization Video
## Chemical Interference

Many process chemicals fluoresce, and many fluoresce more than oil.

The fluorescence of chemical additives can swamp the fluorescence of oil in certain parts of the optical Spectra, creating a false high ppm reading.

### The affects of process chemicals following retuning of the analyser

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Typically</th>
<th>Concent’n</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC1110A</td>
<td>Corrosion inhibitor</td>
<td>42 ppm</td>
<td>15ppm</td>
<td>1.2ppm</td>
</tr>
<tr>
<td>EC2176A</td>
<td>Demulsifier</td>
<td>9 ppm</td>
<td>7.2ppm</td>
<td>0.6ppm</td>
</tr>
<tr>
<td>EC1188A</td>
<td>Heating medium Cl</td>
<td>0.60 ppm</td>
<td>0.0ppm</td>
<td>0.0ppm</td>
</tr>
<tr>
<td>EC1442A</td>
<td>Corrosion inhibitor</td>
<td>45 ppm</td>
<td>6.2ppm</td>
<td>0.0ppm</td>
</tr>
<tr>
<td>EC9021A</td>
<td>H2S scavenger</td>
<td>73 ppm</td>
<td>6.9ppm</td>
<td>0.0ppm</td>
</tr>
<tr>
<td>EC6354A</td>
<td>Coagulant/de-oiler</td>
<td>100 ppm</td>
<td>0.0ppm</td>
<td>0.0ppm</td>
</tr>
<tr>
<td>EC1470A</td>
<td>Corrosion Inhibitor</td>
<td>100ppm</td>
<td>6.5ppm</td>
<td>0.7ppm</td>
</tr>
<tr>
<td>Methanol</td>
<td></td>
<td>100%</td>
<td>16ppm</td>
<td>0.0ppm</td>
</tr>
<tr>
<td>Meg</td>
<td></td>
<td>100%</td>
<td>12ppm</td>
<td>0.0ppm</td>
</tr>
</tbody>
</table>
Chemical Interference

Field example of water composition variation over a 6 day period
Interference - example

Recent analysis at Talisman Flotta Terminal

<table>
<thead>
<tr>
<th></th>
<th>21 Mar - 19:25 Norm</th>
<th>2 Apr - 16:04 Low</th>
<th>16 Jun - 3:52 High</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OM ppm</strong></td>
<td>Normal</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2</td>
<td>6.8</td>
</tr>
<tr>
<td><strong>Lab ppm</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>540.09 nm</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7163.21</td>
<td>5914.15</td>
<td>10386.42</td>
</tr>
<tr>
<td><strong>flu ratio</strong></td>
<td>1.00</td>
<td>0.83</td>
<td>1.45</td>
</tr>
<tr>
<td><strong>ppm sim</strong></td>
<td>4.00</td>
<td>3.00</td>
<td>6.20</td>
</tr>
<tr>
<td><strong>610.18 nm</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3245.67</td>
<td>2859.09</td>
<td>2724.49</td>
</tr>
<tr>
<td><strong>flu ratio</strong></td>
<td>1.00</td>
<td>0.88</td>
<td>0.84</td>
</tr>
<tr>
<td><strong>ppm sim</strong></td>
<td>3.80</td>
<td>3.40</td>
<td>3.30</td>
</tr>
</tbody>
</table>
Chemical Interference – Evaluating Water Composition

Concern that high ppm (>1000ppm) was a process chemical effect.

Results indicate the high ppm reading was oil.
Improving Analyser & Lab Correlation

• Sample Take-off proximity
  – The ideal location to draw a sample adjacent to the analyser.

• Drawing The Sample
  – Depending on flow and pressure 2 minutes can elapse while drawing the sample.

• In very stable conditions,
  – a quick glance at the ppm levels displayed on the analyser is enough to take a reading.

• In rapidly fluctuating conditions
  – multiple measurements from the analyser must be recorded whilst the sample is being drawn.
Sample Duration and Relevance

- The EX1000 takes measurements every sec.
- In this example **70 seconds** had elapsed in drawing the sample.
- The measurements ranged from **637ppm** to **823ppm**
- The average reading from the analyser data was **725ppm**
- The laboratory was **758ppm**
Importance of a Control Sample

- The accuracy and repeatability of the laboratory is critical when trying to establish alignment of the analyser to the lab.
- A control sample is necessary in evaluating the above.
  - E.g. Draw on large sample, mixed thoroughly and divide into three sample bottles.
- Results from a recent installation:

  **Analyser result Avg**
  1056ppm

  **Lab results were**
  1. 469ppm
  2. 1269ppm
  3. 933ppm

  *300% variation for the same sample!*
Chevron Tantawan FPSO
Installed Dec 2006 No Maintenance or Cleaning Required.
Individual Sample Results Jan-Feb 2008
Talisman Flotta

Talisman Flotta 240 grab samples over a Six Week Period

- PPM Reading OIW Display
- Lab Results OIW ppm
## Summary Results & Current Status

### Previous Experience

<table>
<thead>
<tr>
<th>Company</th>
<th>Application</th>
<th>Analysers Used*</th>
<th>Fauling</th>
<th>Blocking</th>
<th>Chemical Interference</th>
<th>Maintenance Interval</th>
<th>Measurement correlation to Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chevron</td>
<td>Discharge</td>
<td>Various</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Days</td>
<td>Process Dependant</td>
</tr>
<tr>
<td>Talisman</td>
<td>Discharge</td>
<td>Various</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Days</td>
<td>Process Dependant</td>
</tr>
<tr>
<td>Statoil Hydro</td>
<td>Discharge &amp; P.Mgm't</td>
<td>Various</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Days</td>
<td>Process Dependant</td>
</tr>
</tbody>
</table>

### Current Experience

<table>
<thead>
<tr>
<th>Company</th>
<th>Application</th>
<th>Replacement Analyser</th>
<th>Fauling</th>
<th>Blocking</th>
<th>Chemical Interference</th>
<th>Maintenance Interval</th>
<th>Measurement correlation to Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chevron</td>
<td>Discharge</td>
<td>EX1000</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Consistant</td>
</tr>
<tr>
<td>Talisman</td>
<td>Discharge</td>
<td>EX1000</td>
<td>None</td>
<td>None**</td>
<td>None</td>
<td>None</td>
<td>Consistant</td>
</tr>
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<td>Statoil Hydro</td>
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<td>None</td>
<td>None**</td>
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<td>None</td>
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</tr>
</tbody>
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**Chevron** - Have already reduced grab sample frequency.

**Talisman** – Preparing a program to stop using grab samples

**Statoil Hydro** - Re-initiated program to replace grab samples
Selecting an Analyser - Guidelines

- Range:
- Maintenance Requirement:
- Cleaning Requirement:
- Blocking:
- Chemical Interference:
- Sample Pressure Variation:
- Flow Variation:
- Gas Bubble interference:
- Solids Interference:
- Wetted Part Materials:
- Remote Connectivity and Support:
- Remote alarming:
- Data logs:
- User Interface:
- Water Composition:
- Proof of Performance:
- Hazardous Environment:

Ask these questions From Customer References
END