Advances in Quantification of Miscible Contamination in Hydrocarbon and Water Samples from Downhole to Surface Laboratories

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Julian Y. Zuo, Adriaan Gisolf, Thomas Pfeiffer, Vladislav Achourov, Li Chen, Oliver C. Mullins, Simon Edmundson, Ashers Partouche
OBM Decontamination Methods in PVT Laboratories

Fundamental Assumption: \( C_{8+} \) of native fluid follows an exponential decay

- **Subtraction Method**: Known OBM composition
- **Skimming Method**: Unknown OBM composition

**Downhole**: real time Multi-sensor contamination monitoring

Uncovering discrepancies is difficult

Evaluate applicability
Oil from Multiple Charges - WBM

GOR = 680 scf/bbl
Bo = 1.34
Software: 8.25wt%
OBM Contamination

In Water Based Mud!
Full Workflow – Formation Testing Sampling

**Preprocess**

- Virgin Fluid Endpoints
- Filtrate Endpoints
- OBM%
- Comparison with Lab Data

**Cleanup Data – DFA Measurements**

- OD
- Density
- GOR
- FVF

**Power Law Fitting in log-log Plot**

- Fitting Interval
- OD vs. M. GOR
- Density vs. Mod. GOR

**Linearity & Endpoints**

- Filtrate from extrapolating to 0 GOR
- Modified GOR, scf/bbl
- Virgin oil from power law fitting

**PO volume, cm³**

**Model and measured data are overlapped**

**Comparison with Lab Data**

<table>
<thead>
<tr>
<th>Channel</th>
<th>Color OD</th>
<th>Density g/cm³</th>
<th>GOR scf/STB</th>
<th>Average</th>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mud Filtrate</td>
<td>0</td>
<td>0.7847</td>
<td>0</td>
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<tr>
<td>Native Oil</td>
<td>0.8862</td>
<td>0.7205</td>
<td>914.83</td>
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<tr>
<td>Sampling Point</td>
<td>0.8768</td>
<td>0.7214</td>
<td>891.41</td>
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<tr>
<td>OBM, vol%</td>
<td>1.06</td>
<td>1.52</td>
<td>2.56</td>
<td>1.71</td>
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<tr>
<td>OBM, wt%</td>
<td>1.15</td>
<td>1.65</td>
<td>2.78</td>
<td>1.86</td>
<td>3.5</td>
</tr>
</tbody>
</table>

**Schlumberger-Private**
Conclusions

Laboratory analysis
• Uses “exponential decay”
• Struggles with Biodegraded oil or multiple charges

Downhole analysis
• Independent of “exponential decay”
• Uses power law fitting & x-plots
• Offers quality control

➢ Laboratory has long been the “ground truth”
➢ Multi sensor OCM is a real alternative when the Lab struggles