Assessment of Maturity in Condensates & light crudes – a brief guide

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Highly mature / high API oils and condensates very often have both lost their heavier molecular weight aliphatic hydrocarbons and indicative maturity ratios have reached equilibrium. It is therefore difficult to ascribe a maturity value to the product fluid post peak oil window without examination of the aromatic component where some reactions (e.g. aromatisation and cleavage /cracking) persist to quite elevated levels of maturity.

Sterane epimerisation is generally thought to have reached equilibrium at an equivalent of ~1% Ro; however it is sometimes possible to follow the Methyl Phenanthrene Index (MPI) and certain steroidal aromatic ratios into the gas window.
Phenanthrenes & methyl Phenanthrenes

To calculate MPI

- GC MPI = 1.5 \times \left(\frac{2\text{MP} + 3\text{MP}}{\text{P}} + 1\text{MP} + 9\text{MP}\right)
- GCMS MPI = 1.89 \times \left(\frac{2\text{MP} + 3\text{MP}}{\text{P}} + 1.26(1 + 9\text{MP})\right)

Relationship between MPI and Ro%:

- \text{Rc\%} = 0.6\text{MPI} + 0.40 \text{ for } \text{Ro\%} < 1.35
- \text{Rc\%} = -0.6\text{MPI} + 2.30 \text{ for } \text{Ro\%} < 2.00

* Ref personnel com Prof. S Rowland 1991
Formulae for aromatic ratios using peaks areas

\[ A1 = \frac{X}{(A+X)} \]

\[ A2 = \frac{A}{(D-C((B/A)-1+A)} \]

Where:

A = Area of the C28(20R) Triaromatic in the m/z 231 ion chromatogram

B = Area of the C27(20R) Triaromatic in the M/z 231 ion chromatogram

C = Area of the C29(20R) Monoaromatic in the M/z 253 ion chromatogram

D = Area of the C28(20R) Monoaromatic and the C29(20R,5BH) Monoaromatic in the M/z 253 ion chromatogram,

X = Area of C20 Triaromatic in the M/z 231 ion chromatogram

(Ref McKenzie)

Typical mid mature oil mono-aromatic hydrocarbon distribution
Mono-aromatic hydrocarbons – NB co-elution problems and the need for GC MSMS
Triaromatic steroidal hydrocarbons – Peak identification
### Optical and molecular maturity parameters compared

<table>
<thead>
<tr>
<th>Maturity</th>
<th>Oil Generating</th>
<th>Immature</th>
<th>Early zone of oil generation</th>
<th>Zone of peak oil generation</th>
<th>Late zone of condensate generation</th>
<th>Early zone of condensate generation</th>
<th>Zone of dry gas with condensate generation</th>
<th>Zone of dry gas generation</th>
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</thead>
<tbody>
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<td>Gas Generating</td>
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<td>1.4</td>
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