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DHI Spill Analysis Data Sheets

Data Sheets for Different Oils

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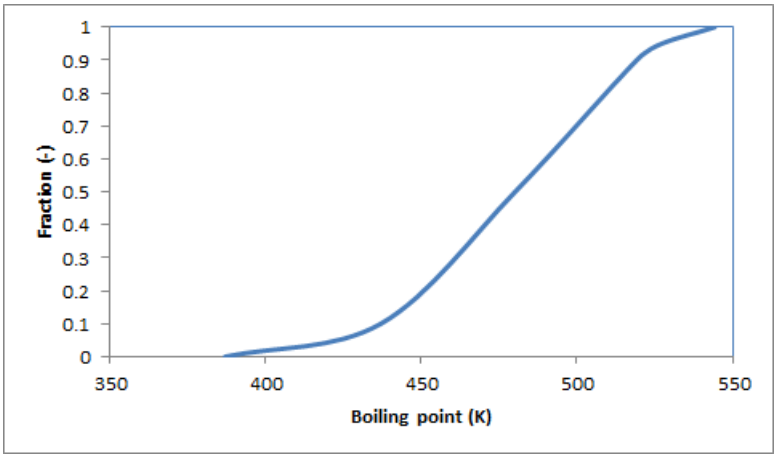
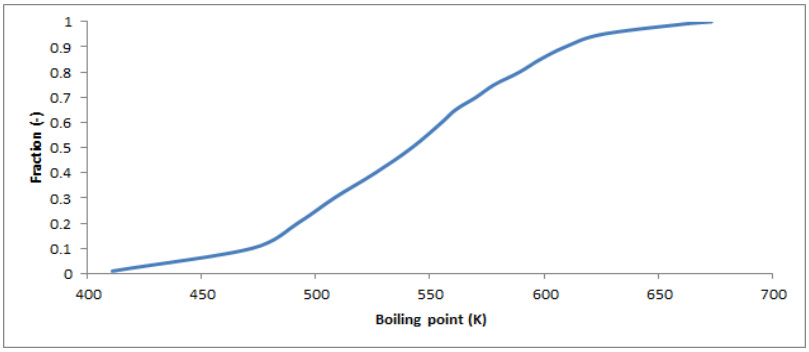
1 Very Light Oils or Light Distillates

Characterisation of Oil for Spill Analysis	
Oil Characteristics	**Very Light Oils or Light Distillates**
Short description	Basis for the characterization of the oil was the data from the Concawe product dossier on kerosines/jet fuels /1/.
Viscosity	The viscosity of two of the oils is specified in /1/. The viscosity for both oils is specified to be 2.0 cst at 20°C (range given as 1.5- 2.5 cst for kerosenes;).
Max water content	No values for the max water content for the oils are specified. The oil is assessed to be little capable of forming water-in-oil emulsions. Therefore, a low max value of 50% is suggested.
Asphaltene	Asphaltene content not specified. However, a very low value is assumed –0.01 wt%, which is the lowest value given for asphaltene content in /2/.
Wax	Wax content not specified. However, a very low value is assumed –1 wt%, which is the lowest value given for wax content in /2/.
Destillation curve	Based on the specification given in /1/, the below distillation curve is produced. 
Aromatics	A value of 20.3% for the content of aromatics was specified /1/. It was assumed that each boiling fraction contains 20.3% aromatics
Cycloparaffins	The content of cycloparaffins is reported as 27.4 wt% /1/. The content of paraffins is reported as 50.5 wt%. The ratio between paraffins and cycloparaffins is thus 1.8. This ratio was used for all paraffin fractions

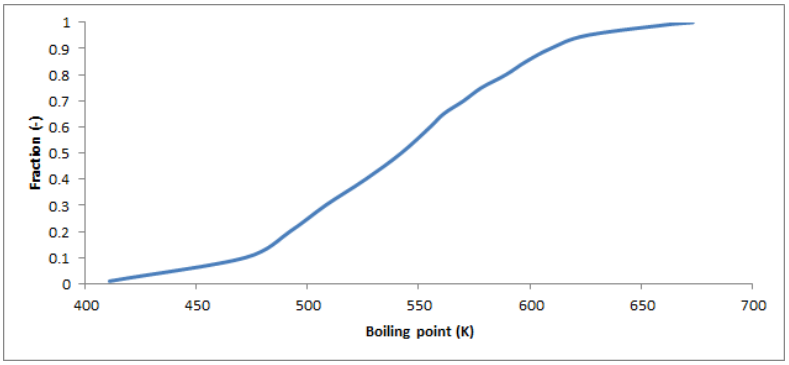
<table>
<tr><td>Composition of oil fractions</td><td>
<table>
<tr><th>Oil fraction</th><th>Tb (ºC)</th><th>Content (ww%)</th></tr>
<tr><td>C8-C12(Paraffins)</td><td>69-230</td><td>37.7</td></tr>
<tr><td>C13-C25 (Paraffins)</td><td>230-405</td><td>14</td></tr>
<tr><td>C6-C12 (Cycloparaffins)</td><td>70-230</td><td>20.5</td></tr>
<tr><td>C13-C23 (Cycloparaffins)</td><td>230-405</td><td>7.6</td></tr>
<tr><td>C6-C11(Aromatics)</td><td>80-240</td><td>14.7</td></tr>
<tr><td>C12-C18 (Aromatics)</td><td>240-400</td><td>5.5</td></tr>
<tr><td>C9-C25 (Naphtene)</td><td>180-400</td><td>0</td></tr>
<tr><td>Residuals</td><td>>400</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>References</td><td>/1/: Concawe (1995): Product dossier no. 94/106. Kerosines/jet fuels. CONCAWE's Petroleum Products and Health Management Groups
/2/: Database contained in Adios 2, version 2.0.1.</td></tr>
<tr><td>Date</td><td>June 2011.</td></tr>
</table>

2 Light Oils or Middle Distillates – Low Aromatic (< 30%)

Characterisation of Oil for Spill Analysis	
Oil Characteristics	**Light Oils or Middle Distillates – Low Aromatic (< 30%)**
Short description	Basis for the characterization of the oil was the data for primarily Fuel Oils no 1 or 2 in the Adios Oil database /1/. Supporting information was retrieved from the Concawe product dossier on gas oils (diesel fuels/heating oils) /2/
Viscosity	The viscosity of the oils are retrieved from /1/. The average viscosity is used: 2 cst at 40°C (std. dev. 0.7 cst).
Max water content	No values for the max water content for the oils are specified. The oil is assessed to be little capable of forming water-in-oil emulsions. Therefore, a low max value of 50% is suggested.
Asphaltene	Asphaltene content not specified. However, a very low value is assumed –0.01 wt%, which is the lowest value given for asphaltene content in /2/.
Wax	Wax content was only specified for one oil: 1 wt%. Therefore, a low value is assumed –1 wt%.
Destillation curve	Based on the specification given in /1/, the below distillation curve is produced. 
Aromatics	Based on the information in /1/ and /2/, an average value of around 25% for the content of aromatics was found appropriate. It was assumed that each boiling fraction contains 25% aromatics
Cycloparaffins	The content of cycloparaffins is reported to vary between 20.2 and 26.5 wt%, with an average value of 24 wt% /2/.The average content of non-cyclic paraffins and olefins is around 51 wt%.

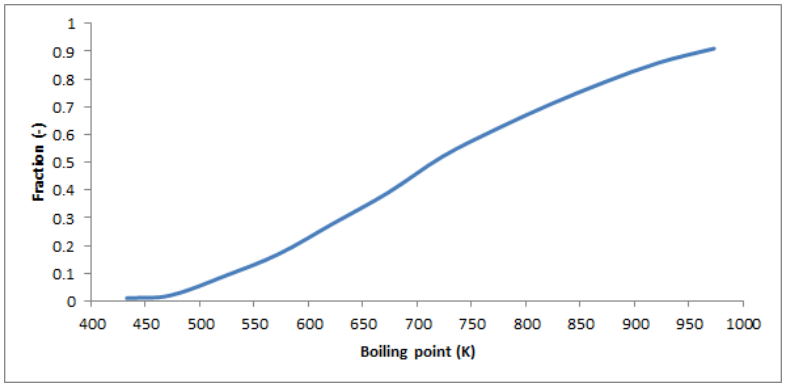
<table>
<tr><td>Composition of oil fractions</td><td>
<table>
<tr><th>Oil fraction</th><th>Tb (ºC)</th><th>Content (ww%)</th></tr>
<tr><td>C8-C12(Paraffins)</td><td>69-230</td><td>15.3</td></tr>
<tr><td>C13-C25 (Paraffins)</td><td>230-405</td><td>35.7</td></tr>
<tr><td>C6-C12 (Cycloparaffins)</td><td>70-230</td><td>7.2</td></tr>
<tr><td>C13-C23 (Cycloparaffins)</td><td>230-405</td><td>16.8</td></tr>
<tr><td>C6-C11(Aromatics)</td><td>80-240</td><td>7.5</td></tr>
<tr><td>C12-C18 (Aromatics)</td><td>240-400</td><td>17.5</td></tr>
<tr><td>C9-C25 (Naphtene)</td><td>180-400</td><td>0</td></tr>
<tr><td>Residuals</td><td>>400</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>References</td><td>/1/: Database contained in Adios 2, version 2.0.1.
/2/: Concawe (1996): Product dossier no. 95/107. Gas oils (diesel fuels/heating oils</td></tr>
<tr><td>Date</td><td>June 2011.</td></tr>
</table>

3 Light Oils or Middle Distillates – High Aromatic (> 30%)

Characterisation of Oil for Spill Analysis	
Oil Characteristics	**Light Oils or Middle Distillates – High Aromatic (> 30%)**
Short description	Basis for the characterization of the oil was the data for primarily Fuel Oils no 1 or 2 in the Adios Oil database /1/. Supporting information was retrieved from the Concawe product dossier on gas oils (diesel fuels/heating oils) /2/
Viscosity	The viscosity of the oils are retrieved from /1/. The average viscosity is used: 2 cst at 40°C (std. dev. 0.7 cst).
Max water content	No values for the max water content for the oils are specified. The oil is assessed to be little capable of forming water-in-oil emulsions. Therefore, a low max value of 50% is suggested.
Asphaltene	Asphaltene content not specified. However, a very low value is assumed –0.01 wt%, which is the lowest value given for asphaltene content in /2/.
Wax	Wax content was only specified for one oil: 1 wt%. Therefore, a low value is assumed –1 wt%.
Destillation curve	Based on the specification given in /1/, the below distillation curve is produced. 
Aromatics	Based on the information in /2/, an average value of around 66% for the content of aromatics was found appropriate. It was assumed that each boiling fraction contains 66% aromatics
Cycloparaffins	The content of cycloparaffins is reported to vary between 8.2 and 10.3 wt%, with an average value of 9 wt% /2/.The average content of non-cyclic paraffins and olefins is around 24 wt% /2/.

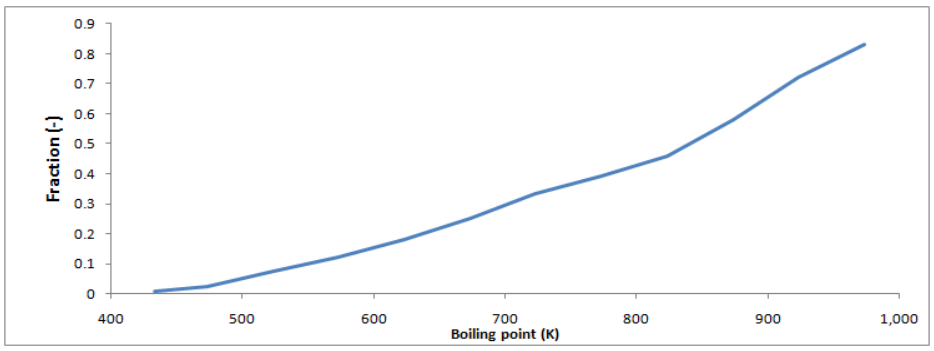
<table>
<tr><td>Composition of oil fractions</td><td>
<table>
<tr><th>Oil fraction</th><th>Tb (ºC)</th><th>Content (ww%)</th></tr>
<tr><td>C8-C12(Paraffins)</td><td>69-230</td><td>7.4</td></tr>
<tr><td>C13-C25 (Paraffins)</td><td>230-405</td><td>17.3</td></tr>
<tr><td>C6-C12 (Cycloparaffins)</td><td>70-230</td><td>2.8</td></tr>
<tr><td>C13-C23 (Cycloparaffins)</td><td>230-405</td><td>6.5</td></tr>
<tr><td>C6-C11(Aromatics)</td><td>80-240</td><td>19.8</td></tr>
<tr><td>C12-C18 (Aromatics)</td><td>240-400</td><td>46.2</td></tr>
<tr><td>C9-C25 (Naphtene)</td><td>180-400</td><td>0</td></tr>
<tr><td>Residuals</td><td>>400</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>References</td><td>/1/: Database contained in Adios 2, version 2.0.1.
/2/: Concawe (1996): Product dossier no. 95/107. Gas oils (diesel fuels/heating oils</td></tr>
<tr><td>Date</td><td>June 2011.</td></tr>
</table>

4 Medium Oils

Characterisation of Oil for Spill Analysis	
Oil Characteristics	**Medium Oils**
Short description	Basis for the characterization of the oil was the data for crude oils of class 4 in the Adios Oil database /1/.
Viscosity	The viscosity of the oils are retrieved from /1/. The geomean viscosity is used: 1310 cst at 40°C.
Max water content	No values for the max water content for the oils are specified. The oil is assessed to have high capabilityof forming water-in-oil emulsions. Therefore, a max value of 85% is suggested.
Asphaltene	The geomean asphaltene content of the selected oils is suggested: 11.5 wt% /1/.
Wax	The geomean wax content of the selected oils is suggested: 2.2 wt% /1/.
Destillation curve	Based on the specification given in /1/, the below distillation curve is produced. 
Aromatics	The geomean aromatic content of the selected oils is suggested: 33 wt% /1/. It was assumed that each boiling fraction contains 33% aromatics
Paraffins	Is is assumed that the ratio between cyclo-paraffins and paraffins is 1:2 in all oil fractions.

<table>
<tr><td>Composition of oil fractions</td><td>
<table>
<tr><th>Oil fraction</th><th>Tb (ºC)</th><th>Content (ww%)</th></tr>
<tr><td>C8-C12(Paraffins)</td><td>69-230</td><td>3.6</td></tr>
<tr><td>C13-C25 (Paraffins)</td><td>230-405</td><td>14.3</td></tr>
<tr><td>C6-C12 (Cycloparaffins)</td><td>70-230</td><td>1.8</td></tr>
<tr><td>C13-C23 (Cycloparaffins)</td><td>230-405</td><td>7.1</td></tr>
<tr><td>C6-C11(Aromatics)</td><td>80-240</td><td>2.6</td></tr>
<tr><td>C12-C18 (Aromatics)</td><td>240-400</td><td>10.6</td></tr>
<tr><td>C9-C25 (Naphtene)</td><td>180-400</td><td>0</td></tr>
<tr><td>Residuals</td><td>>400</td><td>60</td></tr>
</table>
</td></tr>
<tr><td>References</td><td>/1/: Database contained in Adios 2, version 2.0.1.</td></tr>
<tr><td>Date</td><td>June 2011.</td></tr>
</table>

5 Heavy Fuel Oil (HFO)

Characterisation of Oil for Spill Analysis	
Oil Characteristics	**Heavy Fuel Oil (HFO)**
Short description	Basis for the characterization of the oil was the data for 4 HFO oils in the Adios Oil database /1/: Bunker C Fuel Oil (Alaska), Bunker C Fuel Oil, Fuel Oil No.6 And Marine Intermediate Fuel Oil.
Viscosity	The viscosity of two of the oils is specified in /1/. The viscosity for both oils is specified to be 211 cst at 50°C.
Max water content	No values for the max water content for the four oils are specified. The oil is assessed to be very capable of forming water-in-oil emulsions due to the high content of asphaltenes and wax. Therefore, a high max value of 85% is applied.
Asphaltene	The asphaltene content was specified for all 4 of the selected oils (11%, 6%, 6%, 10%) in /1/. The geomean value of 8% was applied.
Wax	The wax content was specified for 3 of the selected oils (2%, 12%, 12%) in /1/.The geomean value of 7% was applied.
Destillation curve	Based on the distillation curves of the four oils, the distillation curve for the HFO oil was found as the average fraction at each temperature. This gave the below distillation curve: 
Aromatics	The content of aromatics was specified for 3 of the selected oils (47%, 55%, 55%) in /1/.The geomean value of 24% was applied. It was assumed that each boiling fraction contains 24% aromatics
Cycloparaffins	The ratio between cycloparaffins to other paraffins in HFO was assumed to be 1:3. This ratio was used for all paraffin fractions.

<table>
<tr><td>Composition of oil fractions</td><td>
<table>
<tr><th>Oil fraction</th><th>Tb (ºC)</th><th>Content (ww%)</th></tr>
<tr><td>C8-C12(Paraffins)</td><td>69-230</td><td>4.3</td></tr>
<tr><td>C13-C25 (Paraffins)</td><td>230-405</td><td>10.1</td></tr>
<tr><td>C6-C12 (Cycloparaffins)</td><td>70-230</td><td>1.4</td></tr>
<tr><td>C13-C23 (Cycloparaffins)</td><td>230-405</td><td>3.4</td></tr>
<tr><td>C6-C11(Aromatics)</td><td>80-240</td><td>1.8</td></tr>
<tr><td>C12-C18 (Aromatics)</td><td>240-400</td><td>4.3</td></tr>
<tr><td>C9-C25 (Naphteon)</td><td>180-400</td><td>0</td></tr>
<tr><td>Residuals</td><td>>400</td><td>74.7</td></tr>
</table>
</td></tr>
<tr><td>References</td><td>/1/: Database contained in Adios 2, version 2.0.1.</td></tr>
<tr><td>Date</td><td>March 2011.</td></tr>
</table>