Amodrill® Olefin Fluids for Land Drilling

Ineos Oligomers offers a range of products to the oilfield drilling arena. The following table identifies the products recommended for drilling on land and their typical properties within each of these categories. Ineos alpha olefins are clear, colorless, water-white, mobile liquids, which are 99+% olefinic.

Typical Properties

<table>
<thead>
<tr>
<th></th>
<th>Amodrill 1410</th>
<th>Amodrill 1400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinematic Viscosity, cSt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 °C</td>
<td>1.87</td>
<td>1.90</td>
</tr>
<tr>
<td>100 °C</td>
<td>0.87</td>
<td>0.91</td>
</tr>
<tr>
<td>Pour Point</td>
<td>-18 °C</td>
<td>-34 °C</td>
</tr>
<tr>
<td>Flash Point</td>
<td>116 °C</td>
<td>116 °C</td>
</tr>
<tr>
<td>Aniline Point</td>
<td>65 °C</td>
<td>68 °C</td>
</tr>
<tr>
<td>Density</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.6 °C, g/mL</td>
<td>0.775</td>
<td>0.775</td>
</tr>
<tr>
<td>60 °F, lb/gal</td>
<td>6.47</td>
<td>6.47</td>
</tr>
</tbody>
</table>

1Typical properties will vary within specification limits.

Drilling Performance of Olefin Fluids

Olefin fluids have been used offshore for more than a decade.

In land drilling trials, the low density of LAO fluids has led to improved rates of penetration.

Health Safety and Environmental Attributes of Amodrill Synthetic Olefins

- Reduced exposure to fugitive emissions of aromatic compounds vs. diesel and mineral oil
- Low volatility
- Flash points above 100°C
- Lower odor than diesel oil
- Rapid biodegradation in soil
- Low toxicity in soil to bacteria, plants and worms
### Drilling Fluid Comparison Table (Ref 1)

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Aromatic Content, wt%</th>
<th>Polynuclear Aromatic Hydrocarbon (PAH) Content</th>
<th>Viscosity 40°C, cSt</th>
<th>Pour Point</th>
<th>Flash Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amodrill 1410</td>
<td>0%</td>
<td>&lt;0.001%</td>
<td>1.87</td>
<td>-18°C</td>
<td>116°C</td>
</tr>
<tr>
<td>Amodrill 1400</td>
<td>0%</td>
<td>&lt;0.001%</td>
<td>1.90</td>
<td>-34°C</td>
<td>116°C</td>
</tr>
<tr>
<td>Low Tox Mineral Oil</td>
<td>&lt;2.2%</td>
<td>&lt;0.001%</td>
<td>3.78</td>
<td>-21°C</td>
<td>128°C</td>
</tr>
<tr>
<td>Isomerized Paraffin</td>
<td>&lt;0.1%</td>
<td>&lt;0.1%</td>
<td>4.15</td>
<td>-57°C</td>
<td>135°C</td>
</tr>
<tr>
<td>#2 Diesel Oil</td>
<td>&gt;30%</td>
<td>12.5%</td>
<td>2.07</td>
<td>-33°C</td>
<td>66°C</td>
</tr>
</tbody>
</table>

### Test Results of Drilling Fluids in Soil¹ (Ref 1)

<table>
<thead>
<tr>
<th>Test</th>
<th>Amodrill 1410</th>
<th>Isomerized Paraffin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Degradation after 93 days²</td>
<td>96%</td>
<td>45%</td>
</tr>
<tr>
<td>Lettuce Seed Germination, Day 93³</td>
<td>88</td>
<td>0</td>
</tr>
<tr>
<td>Microtox® Fluorescent Bacteria Test IC50⁴</td>
<td>83,103</td>
<td>101, 53</td>
</tr>
<tr>
<td>Earthworm Toxicity⁵</td>
<td>Day 0</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Day 93</td>
<td>Extreme</td>
</tr>
</tbody>
</table>

¹. All tests run in subsoil at 2% by weight test fluid to dry soil.
². Degradation at 2% in soil for 93 days; difference in total extractable hydrocarbon at beginning and end of test.
³. Lettuce seed germination relative to control soil after 93-day degradation of fluid in soil, Day 93.
⁴. Percent fluorescent bacteria inhibition of water extract from soil relative control soil at Day 0 and Day 93.
⁵. Worm survival at two weeks in soil on addition of fluid, Day 0, and after degradation, Day 93.

### Drilling Performance of Olefin Fluids

Olefin fluids used to drill nine wells in Canada.

Amodrill 1400 and 1410 olefin-based muds (90/10) improved rates of penetration.

In rock with >15,000 psi compressive strength olefin muds drilled nearly 50% faster than similar diesel oil muds.

### Noel Nikanassin-Days vs. Depth Days from Spud (to Rig Release)

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**Reference**

Regulatory Information
The product and uses described herein may require global product registrations and notifications for chemical inventory listings, or for use in food contact or medical devices. For further information, send an e-mail to: oligomersmsds@ineos.com

Health and Safety Information
The product described herein may require precautions in handling and use because of toxicity, flammability, or other consideration. The available product health and safety information for this material is contained in the Material Safety Data Sheet (MSDS) that may be obtained by calling +1-866-363-2454 (Toll Free-North America), or by sending an e-mail to: oligomersmsds@ineos.com. Before using any material, a customer is advised to consult the MSDS for the product under consideration for use.

The Material Safety Data Sheet for this product contains shipping descriptions and should be consulted, before transportation, as a reference in determining the proper shipping description. If the material shipped by INEOS Oligomers is altered or modified, different shipping descriptions may apply and the MSDS of the original material should not be used.

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