INNOVATIONS IN OIL BLOCK STRUCTURE

HIGH-VACUUM "DRY" DISTILLATION OF ATMOSPHERIC RESID

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The reduction in petroleum feedstock resources has exacerbated the problem of exhaustive refining of atmospheric resid and has shrunk the boiler fuel market [1]. The degree of refining crude oil as a whole is also a function of the degree of proficiency of refining atmospheric resid, producing fuel or lube distillates. The maximum yields of these products are determined on one hand by the possibilities of their subsequent processing and on the other by the equipment and technical implementation of the subsystem for vacuum distillation of atmospheric resid (pressure losses, efficiency of one theoretical plate of the contact system, economy and ecology of the vacuum system — (VS), which ensues low residual pressure in the tower).

The use of vacuum distillates as feedstock for catalytic cracking is restricted by their color index and causes a decrease in the end point. For vacuum distillates as feedstock for oil blocks, the end point and viscosity, as well as the color, are limiting [2]. For this reason, in modernizing or reconstructing atmospheric resid vacuum distillation subsystems, it is necessary to begin with the indicated requirements for the quality of the distillates [3 - 6].

In addition, the size of the existing vacuum towers does not permit the necessary number of separation sections and sufficient volume of packing in these sections. As a result, it is neither possible to increase the distillation yields, decrease the yield of vacuum resid, nor improve its quality. The yield of black product from the washing section (over the feed zone) recommended for attaining the last goal decreases the amount of reflux circulating between the stripping and concentration sections of the tower. As a result, the quality of both highly

<table>
<thead>
<tr>
<th>Feedstock and products</th>
<th>wt. %</th>
<th>tons/h</th>
<th>tons/day</th>
<th>thousand tons/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric resid</td>
<td>50.0</td>
<td>100.0</td>
<td>2400.0</td>
<td>840.00</td>
</tr>
<tr>
<td>Solar cut</td>
<td>1.7</td>
<td>3.4</td>
<td>81.6</td>
<td>28.56</td>
</tr>
<tr>
<td>Lube distillate, °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>330 – 390 (I)</td>
<td>5.5</td>
<td>11.0</td>
<td>264.0</td>
<td>92.40</td>
</tr>
<tr>
<td>390 – 450 (II)</td>
<td>6.5</td>
<td>13.0</td>
<td>312.0</td>
<td>109.20</td>
</tr>
<tr>
<td>450 – 500 (III)</td>
<td>7.7</td>
<td>15.4</td>
<td>369.6</td>
<td>129.36</td>
</tr>
<tr>
<td>500 – 560 (IV)</td>
<td>8.5</td>
<td>17.0</td>
<td>408.0</td>
<td>142.80</td>
</tr>
<tr>
<td>Vacuum resid &gt;560°C</td>
<td>20.0</td>
<td>40.0</td>
<td>960.0</td>
<td>336.00</td>
</tr>
<tr>
<td>Losses</td>
<td>0.1</td>
<td>0.2</td>
<td>4.8</td>
<td>1.68</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50.0</strong></td>
<td><strong>100.0</strong></td>
<td><strong>2400.0</strong></td>
<td><strong>840.00</strong></td>
</tr>
</tbody>
</table>

Note. It was assumed that the installation runs 350 days a year.
viscous distillate III and the vacuum resid is worse.

The creation of highly efficient ordered packings with a height equivalent to one theoretical plate (HETP), from 0.19 to 0.65 m, and minimum possible pressure loss, from 6.67 to 93.59 Pa per theoretical plate, led to the development of a new scheme for vacuum distillation of atmospheric resid. This scheme ensures a maximum total yield of not three, but four lube distillates, and distillate IV (500 – 560°C) is the analog of deasphalted product with an end point no higher than 580°C.

Due to the combination of a highly efficient water injector VS [7] and uniform packing, it became possible to eliminate the use of water vapor as the evaporating agent, i.e., to conduct “dry” distillation of atmospheric resid.

Fig. 1. Schematic diagram of a tower for high-vacuum “dry” distillation of atmospheric resid: 1) separating-stilling tray; 2) input unit; 3) liquid collector; 4) packing layer; 5) nozzle liquid distributor; 6) hydrodynamic liquid distributor; 7) cooler; 1) atmospheric resid from furnace; II) black product; III, IV, V, VI) respectively lube distillates IV, III, II, and I; VII) solar cut; VIII) decomposition gases and air in vacuum system; IX) vacuum resid.