HYDROCRACKED ELUBES STABILIZED WITH AROMATIC AZO COMPOUNDS


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U.S. Cl. 252—51.5 A

12 Claims

ABSTRACT OF THE DISCLOSURE

The light stability of hydrocracked lube oils is improved by incorporating therein a minor amount such as from 0.05 to 0.20 wt. percent of certain azo or azoxy compounds. The azo compounds have the formula:

\[
(R_1) (R_2)_m \quad (R_3)_n \quad (R_4)_l
\]

wherein the Rs are alkyl groups containing from 1 to 10 carbon atoms, \( n \) is a number from 0 to 4, \( m \) is a number from 0 to 5, \( R_1 \) is an alkyl group of from 1 to 5 carbon atoms, \( R_2 \) is an alkyl group of from 1 to 10 carbon atoms and \( R_3 \) is either an alkyl group of from 1 to 10 carbon atoms or a group of the formula

\[
\begin{align*}
\text{O} & \quad \text{C} = \text{C} (\text{R}_4) \\
\end{align*}
\]

wherein \( R \) is an alkyl group of from 1 to 10 carbon atoms. The azoxy compounds have the formula:

\[
\begin{align*}
\text{R} & \quad \text{N} = \text{N} (\text{R}_3) \\
\text{R} & \quad \text{R} (\text{R}_2) \\
\end{align*}
\]

where \( R, R_2, n \) and \( m \) have the meanings defined above, or the formula:

\[
\begin{align*}
\text{O} & \quad \text{C} = \text{C} (\text{R}_4) \\
\end{align*}
\]

wherein \( R_1, R_3 \) and \( n \) have the meanings defined above.

BACKGROUND OF THE INVENTION

In recent years hydrocracking petroleum stocks for the production of lubes has been recognized as a superior technique for the production of lubricating oil. Hydrocracking has a number of distinct advantages over the conventional solvent refining technique in that it generally produces base stocks which have a higher viscosity index and that many crude stocks which do not produce a satisfactory solvent refined lube can be used. However, hydrocracked lube oils suffer from poor stability to light and when exposed to sunlight for an extended period of time of say 30 days discolor and form considerable quantities of sludge. This instability to light can be improved by further refining but this is expensive.

SUMMARY OF THE INVENTION

The present invention is directed to improving the light stability of hydrocracked lube oils by the addition of minor amounts of certain aromatic azo or azoxy compounds to the hydrocracked lube. These compounds function as internal screens which prevent the light energy from interacting with certain polynuclear aromatic sludge precursors. These aromatic azo compounds are quite stable under normal light and oxygen exposure conditions and afford an extended period of photo-oxidative protection to the aforementioned hydrocracked lubricating oils.

DESCRIPTION OF THE INVENTION

Generally, hydrocracked lubricating oils are prepared by treating a deasphalted residium having a viscosity index in the range of about 75 to 100 and a viscosity at 210°F in the range of about 90 to 200 SUS with hydrogen at a temperature of from 650°F. to 825°F., at a pressure of at least 1500 ps.i. and preferably 2500 ps.i. to 3000 ps.i., at a space velocity of from 0.2 to 4.0 and preferably from 0.4 to 1.5. The catalysts used are generally mixtures of nickel sulfide with either molybdenum sulfide or tungsten sulfide supported on alumina or silica alumina. The specificities of hydrocracking are well known in the art. Patents disclosing the technique of hydrocracking include U.S. Pat. No. 2,960,548, issued Nov. 15, 1960, to George W. Ayers et al.

The present invention involves incorporating in the hydrocracked oil a minor amount which usually is less than 0.5 wt. percent and preferably is from 0.01 to 0.2 wt. percent of the oil of a light stabilizer. Below the 0.01 wt. percent level insufficient stabilization is obtained while above 0.2 wt. percent and especially above 0.5 wt. percent the orange-red color of the azo dye stabilizer becomes undesirably noticeable. The stabilizer compounds have one of the following formulas:

\[
\begin{align*}
\text{O} & \quad \text{C} = \text{C} (\text{R}_4) \\
\end{align*}
\]

wherein \( R_4 \) is an alkyl group of from 1 to 10 carbon atoms, \( R_2 \) is an alkyl group of from 1 to 5 carbon atoms, \( R_3 \) is an alkyl group of from 1 to 10 carbon atoms, \( R_4 \) is either an alkyl group of from 1 to 10 carbon atoms or a group of the formula

\[
\begin{align*}
\text{O} & \quad \text{C} = \text{C} (\text{R}_4) \\
\end{align*}
\]

wherein \( R_4 \) is an alkyl group of from 1 to 10 carbon atoms, \( R \) has the meaning defined above, \( n \) is a number from 0 to 4 and \( m \) is a number from 0 to 5.

In addition to the light stabilizer the oil would normally also contain the usual additives such as V.I. improver, antifoam agent, pour depressant, etc.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In each of the Examples the hydrocracked lube oil starting material is prepared in accordance with Example 1 of copending United States Patent Application Ser. No. 78,629, filed Oct. 6, 1970 by Jeffrey R. Thomas and Ibf Steinmetz which is now U.S. Pat. No. 3,663,427.
3,832,304

EXAMPLE I

Solutions of the hydrocracked oil (1000 g.) and the various amounts of 4-N,N-dimethylaminobenzene, reported in Table I were prepared and placed in a window having a southeastern exposure at Marcus Hook, Pennsylvania for six months. The amount of solid sludge formed is reported in Table I.

<table>
<thead>
<tr>
<th>Amount of additive (wt. percent):</th>
<th>Amount of sludge (g.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.20</td>
<td>0.025</td>
</tr>
<tr>
<td>0.10</td>
<td>0.070</td>
</tr>
<tr>
<td>0.5</td>
<td>0.110</td>
</tr>
<tr>
<td>0.01</td>
<td>0.340</td>
</tr>
<tr>
<td>0</td>
<td>2.430</td>
</tr>
</tbody>
</table>

Samples of 10 ml. of oil and 0.1% of the following azo compounds are prepared and heated to 90-100°C for 24 hours with concurrent irradiation from a 275W GE sunlamp. The compounds tested were

4-N,N-dimethylaminobenzene, 4-N,N-dimethylaminobenzene, 4-N,N-dimethylamino-2-methylbenzene, 4-N,N-dimethylamino-3-methylbenzene, 4-ethylphenoxyazoxybenzene, 4-azoxypiperidinol, 4-azoxydiphenetole, azobenzene, 4,4' azoadianiline, 4,4'-azobis(N,N'-dimethylaniline), 4-N,N-dimethylamino-4'-nitroazobenzene and methyl red.

Visual observation of the results indicate that 4-N,N-dimethylaminobenzene - 2 methylbenzene, 4-N,N-dimethylaminobenzene - 2 methylbenzene and 4-N,N-dimethylaminobenzene - 3 methylbenzene are equivalent to 4-N,N-dimethylaminobenzene in imparting light stability to the hydrocracked oil. The results further indicate that the 4,4'-bis(pentoxylazo)oxybenzene, 4-ethylphenoxyazoxybenzene, 4,4'-azoxydiphenetole and 4,4'-azoxydiphenetole were nearly as effective as 4-N,N-dimethylaminoazobenzene in imparting light stability to the hydrocracked oil. The results indicate that the azobenzene, 4,4' azoadianiline, 4,4' azobis(N,N'-dimethylaniline), 4-N,N-dimethylamino-4'-nitroazobenzene and methyl red are essentially ineffective at imparting light stability to the hydrocracked oil.

1. A composition comprising a major portion of a hydrocracked petroleum lubricating oil and as a light stabilizer from 0.05 to 0.2 wt. percent as based on said oil or of a compound having a formula selected from the class consisting of:

\[
\begin{align*}
(R_1) & \text{-O-}(R_2) \\
& \text{N=N} \\
(R_3) & \text{-O-}(R_4)
\end{align*}
\]

wherein \( R \) is an alkyl group of from 1 to 10 carbon atoms, \( R_1 \) is an alkyl group of from 1 to 5 carbon atoms, \( R_2 \) is an alkyl group of from 1 to 10 carbon atoms, \( R_3 \) is an alkyl group of from 1 to 10 carbon atoms or a group of the formula

\[
\begin{align*}
& \text{O} \\
& \text{-(R)_{m}}
\end{align*}
\]

2. The composition of Claim 1 wherein the light stabilizer has the formula

\[
\begin{align*}
(R_1) & \text{-O-}(R_2) \\
& \text{N=N} \\
(R_3) & \text{-O-}(R_4)
\end{align*}
\]

3. The composition of Claim 2 wherein the light stabilizer is 4-N,N-dimethylaminobenzene.

4. The composition of Claim 2 wherein the light stabilizer is 4-N,N-dimethylamino-3-methylbenzene.

5. The composition of Claim 2 wherein the light stabilizer is 4-N,N-dimethylaminobenzene-2-methylbenzene.

6. The composition of Claim 2 wherein the light stabilizer is 4-N,N-dimethylamino-3-methylbenzene.

7. The composition of Claim 1 wherein the light stabilizer has the formula

\[
\begin{align*}
(R_1) & \text{-O-}(R_2) \\
& \text{N=N} \\
(R_3) & \text{-O-}(R_4)
\end{align*}
\]

8. The composition of Claim 7 wherein the light stabilizer is 4,4'-azoxydiphenetole.

9. The composition of Claim 7 wherein the light stabilizer is 4-(4-ethoxyphenoxyazoxybenzene).

10. The composition of Claim 1 wherein the light stabilizer has the formula

\[
\begin{align*}
(R_1) & \text{-O-}(R_2) \\
& \text{N=N} \\
(R_3) & \text{-O-}(R_4)
\end{align*}
\]

References Cited

UNITED STATES PATENTS

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U.S. Cl. X.R.

252—50, 51.5 R; 260—205