**Gasoline Antioxidant**

**PRODUCT DATA SHEET**

**Introduction:**

RCPL Liquid Antioxidant is a liquid mixture of antioxidant, suitable for use in Gasoline, Turbine Oils etc.

**Composition:**

The product is a combination of Aromatic Diamines and sterically hindered phenols type antioxidant, which acts as high performance antioxidant, and prevents gum formation in gasoline. This will aid in meeting the potential gum content specification as per applicable standards and also acts as carburetor detergent, corrosion inhibitor and fuel distribution aid.

**Physical Properties:**

<table>
<thead>
<tr>
<th>Property</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Pale yellow to brown liquid</td>
</tr>
<tr>
<td>Odour</td>
<td>Aromatic</td>
</tr>
<tr>
<td>Solubility</td>
<td>Freely soluble in common organic solvents</td>
</tr>
<tr>
<td>Pour point in °C</td>
<td>Less than (-) 12°C</td>
</tr>
</tbody>
</table>

**Types of antioxidants:**

The effectiveness of an oxidation inhibitor depends upon its chemical structure, the composition of the gasoline to be protected and the conditions under which the gasoline is to be stored. It is important for the antioxidant to be readily soluble in gasoline at all temperatures and to be as insoluble as possible in any aqueous layer that may be present in the bottom of a gasoline storage tank. It should not react with any of the fuel components or other additives, and it should be capable of complete combustion without leaving any residual deposit in the combustion chamber.

Gasoline antioxidants in current use belong to two main classes of chemical compounds i.e. aromatic diamines and alkyl phenols. To a very much smaller extent, amino phenols are also used, but these compounds, although possessing high activity, suffer from the disadvantage of having a relatively high solubility in water and caustic solutions and so can be quickly lost to water bottoms on storage. They have also been reported to contribute to inlet system deposits.
A) Aromatic Diamines:

Paraphenylenediamines are extremely effective antioxidants, particularly for gasoline having a high olefin content, and are usually used in the range of 5-20 ppm. A number of compounds of this type are used commercially and have the general formula:

\[ R - \text{NH} - C_6H_4 - \text{NH} - R' \]

The groups R and R’ can be the same or different and are commonly sec-butyl, isopropyl, 1,4-dimethylpentyl or 1-methylheptyl. One of this class of antioxidant that is frequently used is NN’-di-sec-butyl-phenylenediamine. It has a freezing point of about 14°C and, although it often supercools, it is best used with a diluent at low ambient temperatures.

Although water bottoms in gasoline storage tanks are often somewhat alkaline, it is not impossible for them to be acidic. This can happen when certain processes are used with an inadequate caustic wash and when insufficient time has been allowed for water from such processing to settle out in rundown tankage. In these circumstances there is a risk that some of the diamine antioxidant will be extracted into the water layer and thereby reduce the protection of the gasoline against oxidation.

Other potential problems associated with the amine type of antioxidant are:

1) Discoloration of light-coloured paintwork on vehicles if there is a spillage of fuel down the side of the car during filling, due to oxidation of the molecule.

2) Coloration of the gasoline and/or the water bottoms due to reactions with other compounds present in the gasoline.

On the other hand, this type of antioxidant can generally be used at very much lower concentrations than the alkyl phenol type, and it is often used only for cracked stocks and where the total olefin content of the gasoline is high.

Aromatic diamines have also been used for ‘inhibitor sweetening’, in which the additive acts as a catalyst in the oxidation of the evil-smelling mercaptans to the non-odorous disulphides using dissolved oxygen. The process is rather slow and is no longer widely used except for the removal of traces of any mercaptans left after Merox or similar refinery treatments.

B) Alkylphenols:

This type of antioxidant is most effective in gasoline having a low level of olefins, i.e. below about 10 percent by volume. The most important phenols having good antioxidant activity in gasoline have sterically hindered hydroxyl groups due to the presence of alkyl groups in ditert-butylphenol, 2,4-dimethyl-9,6-tert-butylphenol and 2,6-ditert-butyl phenol. These mixtures have the advantage that they have lower freezing points than the pure materials and can be more cost effective.
Steric hindrance of the hydroxyl group reduces the solubility of the molecule in alkaline water. The water bottoms in refinery gasoline storage tanks are frequently somewhat alkaline. Alkylphenol antioxidants generally suffer fewer adverse side defects than the diamine type but need to be used at higher concentrations to get the same effectiveness – usually 5-100ppm.

**C) Mixture of Aromatic Diamines and Alkylphenols:**

These are reported to outperform equivalent concentrations of either constituent alone. The ratio of diamine to phenolic type used in a mixture depends upon the olefin content of the gasoline. The higher the olefin content, the higher the relative amount of diamine type to be used.

**Dosage :-**

The correct dosage of the antioxidant has to be assessed and fixed after testing in the laboratory with the gasoline samples of the concerned refinery. However, to contain the potential gum within the specified limits of 50 g / m³ Max the following dosage levels are suggested.

**Determination of potential gum in Motor Gasolines as per applicable ASTM standards**

<table>
<thead>
<tr>
<th>Potential gum range in Gasoline (Blank samples without additive) g / m³</th>
<th>Suggested dosage of additive</th>
</tr>
</thead>
<tbody>
<tr>
<td>51 – 120</td>
<td>15 ppm</td>
</tr>
<tr>
<td>121 – 180</td>
<td>20 ppm</td>
</tr>
<tr>
<td>181 – 300</td>
<td>30 ppm</td>
</tr>
</tbody>
</table>

**Mechanism Of Additives working :-**

Gasoline is subject to deterioration due to oxidation, which occurs both during storage and use in an engine. Oxidation gives rise to the formation of gums, which can seriously influence the performance of the gasoline. Gum is the product of a series of oxidation and polymerisation reactions involving mainly the olefinic compounds present in a gasoline. The initial reaction product is a hydroperoxide followed by a series of other reactions giving rise to a complex range of products. Antioxidants function by combining with peroxide free radicals and by decomposing hydroperoxides into stable substances.
**Storage Stability:**

The primary purpose of an antioxidant is to extend the period for which gasoline can be stored before its gum content becomes too high for trouble-free use. In time, all antioxidant in a gasoline will be consumed and then gum formation will increase very rapidly. An antioxidant cannot destroy gum that has already been formed and, because of this, it is essential to add it as early in the refinery processing sequence as possible before the oxidation chain reaction has started. It is normal with cracked streams for the antioxidant to be injected in the rundown line from the process unit to tankage. Additional antioxidant can also be added to the finished gasoline blend.

The response of fuels to an antioxidant in terms of storage stability depends upon the fuel composition, in particular upon the presence and type of olefinic compounds and the nature of the antioxidant used. Blend stability is not related proportionally to the stability of the individual components present, and the performance of an inhibitor in a single blending component is not a reliable criterion of it’s activity in a finished fuel or in a different component.