CARSTAB® DSTD P ANTIOXIDANT

PRODUCT DESCRIPTION
CARSTAB DSTD P is a thioester synergist that is particularly effective as a long-term heat aging stabilizer when used in conjunction with primary antioxidants. CARSTAB DSTD P is highly effective in polypropylene, ABS, and high density polyethylene. CARSTAB DSTD P is a nonvolatile stabilizer and offers low oral and dermal toxicity.

TYPICAL PHYSICAL PROPERTIES
- Acid Number .................................................... 1
- Appearance.......................... white crystalline flake
- Color (% Transmission at 440 nm) ................ 90
- Empirical Formula ............................ C₄₂H₈₂O₄S
- Freezing Point ............................................ 65°C
- Molecular Weight ............................... 682
- Specific Gravity at 80°C ...................... 0.858

Solubility at 25°C .......................... g/100 grams
- Acetone ......................................................... 2
- Ethanol ......................................................... 0.5
- Toluene ......................................................... 13
- Heptane ......................................................... 2
- Ethyl Acetate ................................................ 1
- Water .......................................................... insoluble

SAFETY INFORMATION
CARSTAB DSTD P is not considered hazardous material as defined by the Department of Labor. However, in keeping with good industrial practice, handle with care and avoid unnecessary personal contact.

STANDARD PACKAGING
CARSTAB DSTD P is packaged in polyethylene lined 55 gallon fiber drums of 200 pounds net each, polyethylene lined 30 gallon fiber drums of 100 pounds net each, and polyethylene lined 15 gallon fiber drums of 50 pounds net each.

APPLICATIONS
1. CARSTAB DSTD P is especially recommended to protect polypropylene from oxidation in high temperature applications.
2. CARSTAB DSTD P is very effective in high density polyethylene and other polymers.
3. For applications requiring superior heat stability, a combination of a hindered phenolic antioxidant and CARSTAB DSTD P should be used. It has been found that a combination of three parts of CARSTAB DSTD P to one part of hindered phenolic antioxidant often provides optimum performance. Typical use levels are 0.15% of CARSTAB DSTD P and 0.05% of phenolic antioxidant. It is recommended that specific end use formulations be optimized with regard to thioester synergist ratio and use level.

FDA STATUS
CARSTAB DSTD P is one of a number of antioxidants listed in Section 181.24 of the Food Additives Regulations as having a “prior sanction” for use in the manufacture of food-packaging material. When so used, such substances are not considered “food additives” within the meaning of that term as used in the law. The only limitation on use is that prescribed for all similar antioxidants; namely, that such migration as may occur shall not result in the addition of more than 50 parts per million of the antioxidant to food.

CARSTAB DSTD P is also authorized for use in adhesives in section 175.105 of the Food Additives Regulations and as a component of resinous or polymeric coatings in Section 175.300 of the same regulations.
INTRODUCTION

The mechanism of oxidative polymer degradation is a radical chain process. The degradation process is initiated by the formation of a polymer free radical. This radical can be formed by the homolytic rupture of a chemical bond in the polymer. The initiation can be catalyzed by a variety of factors, such as ultraviolet radiation, ionizing radiation, heat and mechanical processing. Once the polymer radical has formed, it can react with oxygen to form a variety of oxygenated radical species. Initially, many of these species can propagate the decomposition process by yielding a radical which decomposes and by doing so can either cause oxidative chain scission or cross-linking.

The function of antioxidants is to inhibit the formation of the radical species. Hindered phenolic antioxidants are usually considered as chain terminators. Thioester synergists are believed to function in a variety of ways -- as hydroperoxide or peroxide decomposers and as a means of regenerating the primary antioxidant.

The term “synergist” is applied to CARSTAB DSTDP because when it is used in combination with a hindered phenolic antioxidant, the stability is much greater than the sum of the individual components.

THERMAL STABILITY

CARSTAB DSTDP has been processed at temperatures as high as 600°F without excessive color formation or loss of stabilizer. CARSTAB DSTDP is thermally stable and little decomposition occurs after heating at 550°F for extended periods of time.

The resistance of CARSTAB DSTDP to discoloration and volatilization is important as temperatures in this range are being encountered in modern plastic processing.

CHEMICAL PROPERTIES

CARSTAB DSTDP is a relatively inert plastic additive and does not react with most commonly used plastic additives.

VOLATILITY

CARSTAB DSTDP is a relatively nonvolatile stabilizer. At elevated processing temperatures, losses via volatilization will be relatively low for CARSTAB DSTDP.

<table>
<thead>
<tr>
<th>ADDITIVE</th>
<th>WEIGHT LOSS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200°C</td>
</tr>
<tr>
<td>CARSTAB DSTDP</td>
<td>1</td>
</tr>
<tr>
<td>2,6-ditertiarybutyl p-cresol</td>
<td>50</td>
</tr>
</tbody>
</table>

COMPATIBILITY

Compatibility of plastic additives implies good solubility, non migration to the surface and permanence under conditions of use.

Generally hindered phenolic antioxidants are quite compatible in polypropylene at their normal use levels, e.g., 0.02 to 0.3%. Thioesters differ in this respect with CARSTAB DSTDP approaching the limits of compatibility at levels above 0.4%.

The test specimens were stored at room temperature and examined for exudation. The first signs of exudation were recorded and are listed in the following table:

<table>
<thead>
<tr>
<th>ADDITIVE LEVEL (%)</th>
<th>DAYS TO EXUDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>30</td>
</tr>
<tr>
<td>0.6</td>
<td>20</td>
</tr>
<tr>
<td>0.8</td>
<td>12</td>
</tr>
<tr>
<td>1.2</td>
<td>10</td>
</tr>
<tr>
<td>1.4</td>
<td>2</td>
</tr>
</tbody>
</table>

*All sample contained 0.1% of a hindered phenolic antioxidant and 1% carbon black.