Diphenylamine Antioxidants

Introduction

At Chevron Oronite, we foster a culture grounded in operational excellence and are conscientiously committed to protecting people and the environment. This product summary is one example of that commitment.

For engines to perform their everyday functions as well as expected, all their moving parts must be powered and protected with fuels and lubricants enhanced by some of the most technologically advanced additives. The products we produce help fuels and lubricants push the boundaries of speed, strength, cleanliness, and durability.

Oxidation is a common process which results in degradation of lubricating oils. Oxidation occurs when the Hydrocarbon oil chemically reacts with available Oxygen to form a wide variety of oxidation products. There are several factors which affect Oxidation such as high temperature, presence of metals and mechanical stress. Figure 1 below shows some of the common problems that occur following oxidation of the oil, resulting in formation of a variety of products which cause

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corrosion of engine parts, accelerated wear, and sludge and deposit formation.

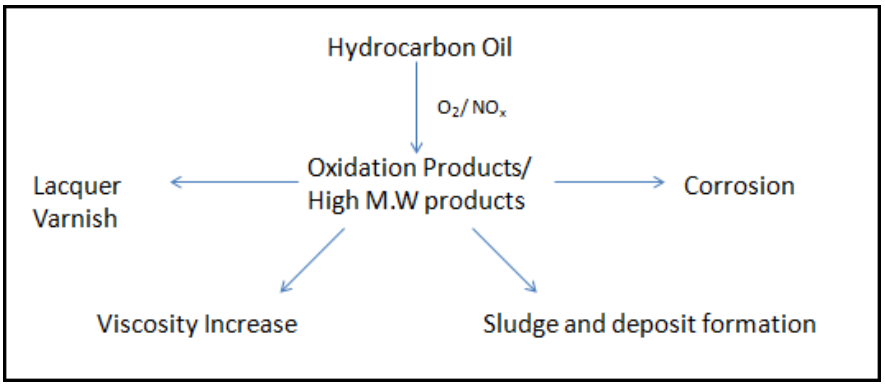

Figure 1. Common problems associated with oxidation of Hydrocarbon Oil.

Antioxidants are a class of chemicals which inhibit oxidation of lubricating oils. By controlling oxidation, antioxidants prevent oil breakdown and thickening, and help engines run longer and smoother. Antioxidants such as diphenylamine (DPA) perform their function by reacting with the free radicals generated by oxidation and prevent further oxidative decomposition of the lubricating oil.

Description and Properties

Diphenylamines (DPA) are viscous, brown oily liquids readily soluble in oil and lighter weight hydrocarbons. They have little or no solubility in water and because they are lighter than water, will float in a water environment. Figure 2 below illustrates a generic structure of diphenylamines.

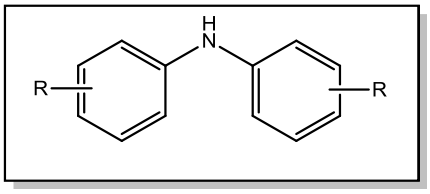

Figure 2. Generic structure of diphenylamines.

Studies of DPA antioxidants by the dermal and oral routes of exposure indicate that these substances are relatively low in acute toxicity.

Health Information

Studies of DPA antioxidants by the dermal and oral routes of exposure indicate that these substances are relatively low in acute toxicity. Due to their low vapor pressure, inhalation toxicity is not expected to be an issue. Signs of systemic toxicity occur in test animals only at very high dose levels that are much greater than typical human exposure.

Studies indicate that some DPA antioxidants may cause skin irritation but are not known to be skin sensitizers. These chemicals are not expected to cause prolonged or significant eye irritation. These chemicals are not expected to be of concern with regard to reproductive and developmental toxicity.

Studies demonstrate that these substances have low potential to be toxic to genetic material in cells and do not present a significant risk for mutagenicity or carcinogenicity in humans.

DPA antioxidants are not toxic aquatic organisms. These substances are not expected to inhibit wastewater treatment plant microorganisms at typical discharge rates.

Environmental Information

Based on test data, DPA antioxidants are not readily biodegradable and may cause long-term adverse effects in the aquatic environment. DPA antioxidants are not acutely toxic to aquatic organisms. These substances are not expected to inhibit wastewater treatment plant microorganisms at typical discharge rates.

In the event of a spill of a product containing DPA antioxidants, stop the source of the release if you can do it without risk. The Material Safety Data Sheet provided with the product contains suggested spill response and clean-up procedures. As appropriate (or required) report spills to local authorities. In the USA, the National Response Center can be reached at 1-800-424-8802.

Regulatory Information

Requirements may exist that govern the manufacture, importation, sale, transportation, use, and/or disposal of DPA antioxidants or products containing them. These requirements may vary by jurisdiction. For more information, consult the relevant Material Safety Data Sheet (MSDS) or contact us.

This summary is based on information as of January 2012.

Exposure Potential

The low volatility and low water solubility of DPA antioxidants limits the potential for exposure, and therefore risk, to people in the workplace and consumers. Indirect exposure to these chemicals via the environment is likely to be negligible. Also, exposure to these substances is low because they comprise only a fraction of the final lubricating oil product.

Manufacturing of DPA antioxidants generally occurs in dedicated closed systems with proper engineering controls, thereby minimizing exposure. Solid waste is either incinerated or recycled and therefore there is no significant release to the environment. Wastewater is treated before release to a sewer or other appropriate system. Workers in manufacturing plants, including those in sample analysis, blending, maintenance, and cleaning are well trained in their particular operations and wear appropriate personal protection equipment, e.g. safety glasses, chemical resistant gloves, etc.

Professional mechanics, service station attendants, and other skilled workers that are frequently exposed to lubricating oil additives while working on engines use personal protective equipment and hygiene practices that reduce exposure to the oil. Consumers have potential for exposure to small amounts of these substances due to the possibility of skin contact while working around engines. However, consumer exposure is likely to be relatively infrequent. In summary, there is minimal potential for exposure to DPA antioxidants to the consumer.

In the event a product containing DPA antioxidants spills, stop the source of the release if you can do it without risk. The Material Safety Data Sheet provided with the product contains suggested spill response and clean-up procedures. As appropriate (or required), report spills to local authorities. In the USA the National Response Center can be reached at 1-800-424-8802.

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Responsible Care® Contact Information

Chevron Oronite Company LLC
Global Responsible Care Manager
6001 Bollinger Canyon Road, K2315
San Ramon, CA 94583

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