Product stewardship summary: Sulfonates

Introduction

At Chevron Oronite, we foster a culture grounded in operational excellence and are 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.

The metallic salts of sulfonic acids belong to the class of lubricating oil additives known as detergents. Unlike household detergents, these detergents are specifically designed to be soluble in oil, and insoluble in water. Detergents are critical components of lubricating oil formulations, providing protection against deposits, corrosive wear and oxidation.

Detergents provide a means for dissolving otherwise insoluble metallic salts, such as calcium or magnesium carbonate, into lubricating oil. These basic compounds have a key function to neutralize acids resulting from fuel combustion and engine oil oxidation, that would otherwise corrode critical metal parts of the engine. Detergents also prevent the buildup of harmful deposits on the rings and in the grooves of the engine pistons. These deposits can cause the rings of the piston to stick, causing potentially catastrophic wear of liners, which leads to loss of engine compression (power), poor emissions quality and fuel economy, and eventually engine failure.

Description and Properties

Sulfonates appear as viscous brown liquids and are insoluble in water. They have no appreciable odor. Per the Occupational Safety and Health Administration (OSHA) guidelines, these materials are not considered flammable or combustible.

Sulfonates consist of a hydrocarbon tail that is responsible for their solubility in lubricating oil, a connecting aromatic group, and a salt forming site (sulfonic acid), also called polar head. The polar head serves as a linking site to a salt base, calcium carbonate which is otherwise insoluble in oil.

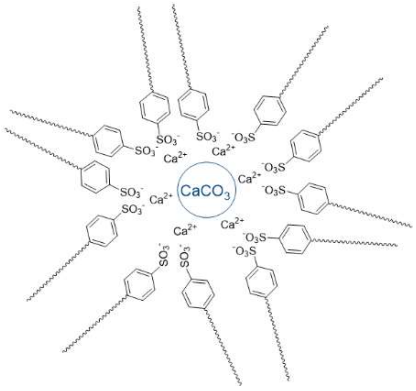

Figure 1: Chemical compound of generic detergent soap.

The “soap” portion of the molecule (the tail and polar head), shown in Figure 1, helps to remove engine deposits, especially on the piston ring and lands. The inorganic salt base neutralizes harmful acids resulting from combustion. The ratio of soap to calcium carbonate base is tailored specifically to the application for which the carboxylate is intended. For instance, sulfonates detergents rich in soap protect against engine deposits and those rich in carbonate base protect against corrosive wear from combustion acids.

Health Information

Studies indicate that sulfonates have low toxicity following acute exposure by dermal, oral and inhalation routes. Signs of systemic toxicity occurred only at very high dose levels, which are much greater than in typical human exposure scenarios. Exposure by inhalation to the highest vapor concentration attainable did not lead to any signs of systemic toxicity.

Studies indicate that sulfonates have potential to cause mild to moderate irritation to skin and eyes according to current regulatory guidelines. Studies have shown that sulfonates are skin sensitizers, but when tested in human patch tests, overbased sulfonates are not potential skin sensitizers.

Repeat exposures to sulfonates by the oral, dermal and inhalation routes caused reversible and non-life-threatening systemic toxicity, low incidence of local skin injury at the site of application, and local injury to the lungs. Evaluation of all the data indicates low toxicity by repeated-dose exposure to sulfonates.

In vitro and in vivo studies demonstrate that these substances lack potential to be toxic to genetic material in cells and do not present a significant risk for mutagenicity or carcinogenicity in humans. Studies provide no evidence of direct effects of repeated doses on reproductive systems or indices.

Environmental Information

Sulfonates are not expected to undergo hydrolysis, photolysis or microbial degradation based on their chemistry, test data and predictive modeling. Additionally, due to their low vapor pressure and low water solubility, they are more likely to partition into soil and sediment than into air and water. Based on current data, sulfonates are unlikely to bioaccumulate in the environment and are not readily biodegradable. Numerous studies indicate that sulfonates are not toxic to aquatic organisms.

Regulatory Information

Requirements may exist that govern the manufacture, importation, sale, transportation, use and/or disposal of sulfonates or products containing them. These requirements may vary by jurisdiction. For more information, consult the Safety Data Sheet.

Exposure Potential

The low volatility and low water solubility of sulfonates limit the potential for exposure, and therefore the risk. Indirect exposure to these chemicals via the environment is likely to be negligible.

Manufacturing of sulfonates generally occurs in dedicated closed systems with proper engineering controls, minimizing exposure. Solid waste is either incinerated or recycled. Therefore, there is no significant release to the environment. Wastewater is treated before it is released. Workers in manufacturing plants, including those who conduct sample analysis, blending, maintenance and cleaning are well trained in their operations and wear appropriate personal protection equipment. Professional mechanics, service station attendants, and other skilled workers wear personal protective equipment and use hygiene practices that reduce exposure to the oil. Consumer exposure may occur while working around engines, but this is likely to be infrequent. In summary, there is minimal potential for exposure to sulfonates to the consumer.

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