Product Safety Assessment

DOW™ Octylphenol Ethoxylate Surfactants


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Names
- CAS No. 9036-19-5
- Octylphenol ethoxylate
- OPE
- Alkylaryl polyether alcohols
- Octylphenoxypolyethoxy-ethanol
- Poly(oxy-1,2-ethanediyl)

- TRITON™ nonionic surfactants
- Octylphenyl polyethylene glycol
- Octylphenol polyoxyethylene ether surfactants
- α-[1,1,3,3-Tetramethylbutyl)phenyl]-ω-hydroxy
- Polyoxyethylene octylphenol

- DOW™ octylphenyl ethoxylate surfactants
- Polyethoxylate
- Polyoxyethylene octylphenyl ether
- Polyethylene glycol octylphenyl ether
- Octoxynol

Product Overview
- Octylphenol ethoxylates (OPEs) are surfactants commonly used in paints, emulsions and wetting agents and are a type of alkylphenol ethoxylate (APE). The Dow Chemical Company (“Dow”) and affiliated companies of Dow sell OPEs under the trade name TRITON™ X octylphenol ethoxylate surfactants. This product family has various molecular weights and properties. The properties of a particular OPE surfactant depend on the number of ethoxylate groups that are attached (the number of ether linkages along the chain), which can vary from just a few up to about one hundred. See Product Description, Product Uses, and Manufacture of Product. NOTE: The trade name TRITON X surfactants is used for surfactants having different chemistry and hazards than TRITON X octylphenol ethoxylate surfactants. Please consult the relevant Safety Data Sheet for hazard and handling information specific to these materials.

- Occupational exposure is possible because OPE is used in a wide variety of industrial and agricultural products; however, exposure is limited during use due to end-use applications. Consumer exposure is also possible but to a lesser extent since OPEs are primarily used in industrial applications. See Exposure Potential.

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The results of numerous mammalian toxicity studies conducted on octylphenol (OP) and octylphenol ethoxylates (OPE), along with an understanding of their occupational and consumer uses support the conclusion that human safety should not be a concern for these compounds. Trace levels of alkylphenol ethoxylates (APEs) found in recent household monitoring studies do not represent a toxicological concern and are significantly below concentrations considered to be safe. Trace levels of octylphenol have been detected in recent human biomonitoring studies conducted by the Centers for Disease Control (CDC). The CDC report emphasizes “the measurement of an environmental chemical in a person’s blood or urine is an indication of exposure; it does not by itself mean that the chemical causes disease or an adverse effect” and “research studies, separate from these data, are required to determine which blood or urine levels are safe.” The CDC report notes “orally administered 4-tert-octylphenol was well absorbed, did not bioaccumulate, and was quickly eliminated from the blood” in rat studies. Some screening level tests have shown that OP and some low-mole (lower molecular weight) OPEs bind weakly to the estrogen receptor in cell cultures, but high-mole (higher molecular weight) OPEs do not. Because the properties of individual TRITON™ X surfactants vary, consult the specific Safety Data Sheet for the material of interest, or see Health Information.

- Octylphenol ethoxylates are inherently biodegradable and can be effectively removed in well functioning sewage treatment plants. They are unlikely to bioaccumulate in the food chain, and range from moderately toxic to toxic to fish and aquatic organisms on an acute basis. See Environmental Information.

- These materials are normally non-reactive; however, prolonged, excessive heat may cause some products to decompose. For further details, see Physical Hazard Information.

Manufacture of Product

- **Capacity** – Global consumption of alcohol ethoxylates in 2009 was estimated to be 612,000 metric tons (1.35 billion pounds). Dow sells alkylphenol ethoxylates globally and has a U.S. production site in Hahnville, Louisiana.

- **Process** – OPE is produced by reacting ethylene oxide and octylphenol with sodium hydroxide as a catalyst. The ratio of ethylene oxide to octylphenol determines the molecular weight of the product, or the length of the molecule produced (see figure below). Sometimes water is added to the product for ease in handling (i.e., liquid versus solid).

![Chemical Reaction Diagram](image)

Product Description

TRITON™ X Series surfactants can be either solids or liquids depending on their molecular weight and use temperatures. The solids are white to yellow in color and commonly diluted with water to yield liquid products. Liquid products are transparent and slightly yellow at room temperature.

TRITON X Series surfactants vary in molecular weight and the number of ether linkages in the polyoxyethylene chain, causing some products to have different solubilities. For example,
TRITON™ X-114 and products of longer chain lengths are soluble in water at room temperature, while TRITON X-45 is considered borderline in oil-water solubility. Increasing temperature makes these surfactants become less soluble in water. Some products may form gels in certain solvents or under the right conditions. Review the Safety Data Sheet for additional information or Contact Us.

Product Uses

TRITON™ X Series surfactants are primarily used in industrial and paint/emulsion applications. However, TRITON X Series surfactants can be used for a wide variety of applications, including:

- **Emulsifiers** – in the manufacture of emulsion polymers and as stabilizers in latex polymers
- **Coatings** – for pigment wetting and stabilization in coatings
- **Agriculture** – as emulsifiers or dispersants
- **Cleaning products (minor use)** – as liquid, paste, or powdered cleaning compounds, and heavy-duty industrial products

Exposure Potential

Octylphenol ethoxylates are used in the production of industrial, agricultural and a limited number of consumer products. Based on the uses for these surfactants, the public could be exposed through:

- **Workplace exposure** – Exposure can occur either in an octylphenol ethoxylates manufacturing facility or in the various industrial, agricultural or consumer product manufacturing facilities that use these surfactants. Because the health risks associated with octylphenol ethoxylates vary, consult the Safety Data Sheet for the product being used. Each manufacturing, commercial service and consumer facility should have appropriate work processes and safety equipment policies in place to limit exposure, including proper ventilation. See Health Information.
- **Consumer exposure to products containing OPE** – Dow does not sell OPE for direct consumer use. However, they can be used as a component in paints, agricultural formulations and other products, so there is a potential for consumers to come into contact with products containing small amounts of these materials. Review product labels and follow all instructions and guidelines for proper use to help prevent unnecessary exposure. See Health Information.
- **Environmental releases** – Most uses of OPEs result in their release to industrial or publicly-owned wastewater treatment plants, where they have been shown to be highly treatable, though trace levels of low mole OPEs (i.e., OPE1 and OPE2) and OP can be released to the environment after treatment. Some uses of OPE (e.g. in formulated agricultural products) can result in their release directly to the environment during use. OPEs are soluble in water and are inherently biodegradable; they continue to degrade in aquatic and terrestrial environments. In the event of a spill, the focus is on containing the spill to prevent contamination of soil, surface or ground water. Use inert materials (e.g., sand, earth) to contain spills. To avoid gelling and foaming problems, do not use a stream of water to flush away spills. Any water that is contaminated with OPE should be sent to a wastewater treatment facility for appropriate treatment to reduce OPE residues to concentrations that pose no harm to the environment. In sufficient concentrations, OPEs can be toxic to aquatic organisms and animals. Consult the relevant Safety Data Sheet for more information about protective equipment and procedures. See Environmental Information, Health and Physical Hazard Information.
- **Large release** – Industrial spills or releases are infrequent and are generally contained. If a large spill does occur, the material should be captured, collected and re-processed, or disposed of according to applicable governmental requirements.
In case of fire – If OPE is present in a fire situation, it can produce carbon monoxide (highly toxic) and carbon dioxide (an asphyxiant at sufficient concentrations). Do not direct a solid stream of water or foam into hot, burning pools; this may cause frothing and increase fire intensity. Avoid accumulation of water. Emergency personnel should wear proper protective equipment, including self-contained breathing apparatus (SCBA), and follow emergency procedures carefully. When relevant in scale or risk, the community should be notified of the hazards associated with the specific release event. See Environmental Information, Health and Physical Hazard Information.

For more information, see the relevant Safety Data Sheet.

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Health Information

The results of numerous mammalian toxicity studies conducted on octylphenol (OP) and octylphenol ethoxylates (OPE), along with an understanding of their occupational and consumer uses support the conclusion that human safety should not be a concern for these compounds. Trace levels of alkylphenol ethoxylates (APEs) found in recent household monitoring studies do not represent a toxicological concern and are significantly below concentrations considered to be safe. Trace levels of octylphenol have been detected in recent human biomonitoring studies conducted by the Centers for Disease Control (CDC). The CDC report emphasizes “the measurement of an environmental chemical in a person’s blood or urine is an indication of exposure; it does not by itself mean that the chemical causes disease or an adverse effect” and “research studies, separate from these data, are required to determine which blood or urine levels are safe.” The CDC report notes “orally administered 4-tert-octylphenol was well absorbed, did not bioaccumulate, and was quickly eliminated from the blood” in rat studies. Some screening level tests have shown that OP and some low-mole (lower molecular weight) OPEs bind weakly to the estrogen receptor in cell cultures, but high-mole (higher molecular weight) OPEs do not.

NOTE: The trade name TRITON™ X surfactants is used for surfactants having different chemistry and hazards than TRITON X octylphenol ethoxylate surfactants. Health information for specific products is summarized on the relevant Safety Data Sheet. It is important to note that health risks associated with individual products may vary based on their formulation or intended use. The Safety Data Sheet is the preferred source for specific health information. These materials may also contain minor components or additives that have additional health risks. An overview of health information for octylphenol ethoxylate products appears below.

Eye contact – Although some products are essentially nonirritating, most range from moderately to severely irritating with the potential for corneal injury.

Skin contact – Although brief contact with some products is essentially nonirritating, other products range from slightly to moderately irritating. Prolonged skin contact for some products may cause moderate irritation and possibly burns; however, prolonged contact is unlikely to result in absorption of harmful amounts.

Ingestion – These products have low toxicity. Small amounts swallowed incidental to normal handling operations are not likely to cause injury.

Inhalation – Prolonged exposure is not expected to result in adverse effects.

Other – In two-year feeding studies, animals that were fed up to 700 mg/kg/day of the 40-mole ethoxylate of octylphenol (OPE40) – the equivalent of eating 48 grams (1.7 ounces) for a 68-kg (150-pound) adult each day for two years – showed no adverse effects.

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Environmental Information

Octylphenol ethoxylates are extensively biodegraded in laboratory screening tests, but do not meet the stringent criteria for classification as readily biodegradable. These substances are inherently biodegradable to carbon dioxide and water, and numerous studies have shown that under conditions in which sufficient oxygen, nutrients, and microorganism concentrations occur, such as in soils, surface waters, and well-functioning wastewater-treatment facilities, the substances are extensively biodegraded. Treatment efficiencies vary, although most facilities typically remove between 80 and 90% (through a combination of biodegradation and adsorption). Small amounts of various metabolites have been detected in effluents from sewage treatment facilities, including low molecular weight octylphenol ethoxylates, ether carboxylates, and octylphenol. Octylphenol is a minor metabolite in aerated systems, although higher levels can be formed during anaerobic treatment of sewage biosolids (sludges).

Octylphenol ethoxylates are not expected to bioaccumulate in the food chain since similar materials (nonylphenol ethoxylates) are metabolized and excreted by fish. This conclusion is supported by an assessment of all commercially relevant alkylphenols and their ethoxylates performed by Environment Canada, which stated that none of the substances met the criteria for persistence or bioaccumulation.

Octylphenol ethoxylates vary in their toxicity, ranging from moderately toxic to toxic to fish and aquatic organisms on an acute basis. The toxicity of octylphenol ethoxylates increases as the length of the ethoxylate chain (molecular weight) decreases.

Alkylphenols and their ethoxylates, like nonylphenol and nonylphenol ethoxylates – similar materials to the octylphenol and its ethoxylates – have been the subject of considerable regulatory attention due to concerns about their aquatic toxicity and weak endocrine activity.

Risk assessments for alkylphenols and their ethoxylates have been conducted by regulatory authorities around the world, including octylphenol ethoxylates (United Kingdom Environment Agency, 2005).

Physical Hazard Information

These materials are normally non-reactive; however, avoid strong bases at high temperatures, strong acids, strong oxidizing agents and materials reactive with hydroxyl compounds. Prolonged, excessive heat may cause some products to decompose.

For more information, see the relevant Safety Data Sheet.
Regulatory Information

Governmental requirements may exist that govern the manufacture, sale, transportation, use and/or disposal of OPEs. These requirements may vary by city, state, country or geographic region. Information may be found by consulting the relevant Safety Data Sheet or Contact Us.

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Additional Information

- Safety Data Sheet (www.dow.com/webapps/msds/msdssearch.aspx)
- Dow's Surfactant web site (www.dowsurfactants.com)
- Alkylphenol Ethoxylates Research Council (www.aperc.org/)
- European Council for Alkylphenols and Derivatives (www.cepad.eu/index.asp)

For more business information about TRITON X™ surfactants, visit Dow's Surfactant web site at www.dow.com/surfactants/.

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References

3. TRITON™ X-15 Safety Data Sheet, The Dow Chemical Company.
5. TRITON™ X-100 Safety Data Sheet, The Dow Chemical Company.


NOTICES:

As part of its 2015 Sustainability Goals, Dow has committed to make publicly available safety assessments for its products globally. This product safety assessment is intended to give general information about the chemical (or categories of chemicals) addressed. It is not intended to provide an in-depth discussion of health and safety information. Additional information is available through the relevant Safety Data Sheet, which should be consulted before use of the chemical. This product safety assessment does not replace required communication documents such as the Safety Data Sheet.

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