Product Safety Assessment
Ortho-Phenylphenol and Sodium Ortho-Phenylphenate

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Names – Neutral Form¹,²,³,⁴
- CAS No. 90-43-7
- ortho-Phenylphenol
- o-Phenylphenol
- OPP
- DOWICIDE™ Antimicrobial

Names – Sodium Salt Form²,⁴,⁵,⁶
- CAS No. 132-27-4
- Sodium o-phenylphenate
- SOPP
- Na-OPP
- Sodium 2-biphenylate
- 2-Phenylphenol, sodium salt
- DOWICIDE™ Antimicrobial

Product Overview
- Most OPP (ortho-phenylphenol) and SOPP (sodium ortho-phenylphenate) products are flake materials with color ranging from white to off-white. They are biocidal products belonging to a class of organic compounds commonly referred to as substituted phenolics.¹,⁵,⁶ See Product Description.
- OPP and SOPP are marketed by Dow for applications in the industrial, institutional, and household markets. They are the active ingredients in disinfectant products used in agricultural and food-handling settings. Applications range from post-harvest preservation of citrus fruit and pears to broad use as a material preservative. Material preservation applications include construction products, metal working fluids, slurries, pigments, and stains. They are also used for sapstain control of freshly cut lumber. SOPP is also used as a preservative in agricultural products applied to certain growing food crops.²,⁷ See Product Uses.
- OPP can cause irritation of the eyes and respiratory tract. It is harmful if swallowed. SOPP (the sodium salt) is corrosive to the eyes and skin, harmful if swallowed, and can cause respiratory tract irritation.¹,⁵,⁶ OPP and SOPP have not produced allergic skin reactions in animal studies, but skin contact may result in allergic skin reactions in a small proportion of individuals.² See Health Information.

¹ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow
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- Dow does not sell OPP and SOPP directly for consumer use. They are formulated into products for the industrial, institutional, and consumer markets and, as a result, have the potential for widespread occupational and consumer exposure. However, consumer exposure is considered much lower compared to occupational exposure. Occupational exposure to OPP and SOPP may occur by inhalation and dermal routes. Consumer exposure to OPP and SOPP may occur by dermal, oral, and inhalation routes. See Exposure Potential.
- OPP is readily soluble in most organic solvents and oils and is only slightly soluble in water. It has a low vapor pressure and may release toxic fumes in fire situations. SOPP is readily soluble in water and in many polar organic solvents. The solubility of SOPP is affected by pH. Good housekeeping and control of dusts are necessary, since these products may form explosive dust-air mixtures. See Physical Hazard Information.

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Manufacture of Product
- **Capacity** – The 2006 global market for OPP and its derivatives is estimated to be 1600 metric tons (3.5 million pounds).
- **Process** – OPP can be produced by different processes, most often by reacting chlorobenzene with caustic soda at elevated temperatures and pressures. The specific route used by Dow is considered proprietary. The sodium salt form, SOPP, can be produced by a controlled reaction of OPP with caustic soda.

![Ortho-phenylphenol (OPP)](image1) ![Sodium o-phenylphenate (SOPP)](image2)

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Product Description
Most OPP (ortho-phenylphenol) and SOPP (sodium ortho-phenylphenate) products are flake materials with color ranging from white to off-white. They are biocidal products belonging to a class of organic compounds commonly referred to as substituted phenolics. They have a mild phenolic odor and are not volatile.

OPP is miscible with most organic solvents and oils, but only slightly soluble in water. SOPP is miscible with water and many polar organic solvents. The solubility of SOPP is affected by pH.

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Product Uses
OPP is effective against a wide variety of organisms, including *Pseudomonas spp.*, *Mycobacterium spp.*, and many types of molds and fungi. This makes OPP and SOPP ideal products for use in a wide range of applications. The primary biocidal applications include the following:

Estimated Use of OPP and Derivatives (2006)
- **Disinfectants**: 65.6%
- **Material preservation**: 28.1%
- **Manufacture of flame retardants**: 6.3%
• **Disinfectants** – Formulated into disinfectants for use in agricultural, food handling, commercial, institutional, industrial, residential, public access, and medical settings. OPP or SOPP is the active ingredient in the disinfectant.

• **Material Preservation** – Formulated into a broad range of products such as metal-working fluids, slurries, paints, stains, construction products, cleaning solutions, and wood products to protect the formulation from biodegradation.

• **Agriculture** – OPP and SOPP may be used for post-harvest preservation of citrus and pears. SOPP may also be incorporated into agricultural products to preserve formulations that are applied to growing food crops.

The primary nonbiocidal application for OPP is as an intermediate in the reaction process for certain flame retardants.

Product uses may be governed by regulations. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Safety Data Sheet, Technical Information, or using Contact Us.

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**Exposure Potential**\(^1,5,6\)

OPP and SOPP are used in the production of industrial, institutional, and consumer products. As a result, they have the potential for widespread human exposure in the workplace and for consumers.

• **Workplace exposure** – Exposure can occur either in manufacturing, formulating, or industrial facilities that use OPP and/or SOPP. A combination of ventilation, respiratory protection, and chemical protective clothing minimizes the risk of exposure. All facilities with OPP and SOPP on site should have a through training program for employees and appropriate work processes and safety equipment in place to limit unnecessary exposure. See Health Information.

• **Consumer exposure to products containing OPP and SOPP** – Dow does not sell OPP or SOPP for direct consumer use. OPP and SOPP are added to residential products, such as disinfectants, and exposure may occur during and after application to hard surfaces.\(^2\) Exposure can occur through the use of the disinfectant product and dietary exposure as the result of food contact to the treated surface. See Health Information.

• **Environmental releases** – Environmental exposure can occur through effluent streams from waste water and accidental spills of the biocide or product containing the biocide.

• **Small spill** – In the event of a small spill, the focus is on containing the spill to prevent contamination of soil and surface or ground water. Proper protective equipment, including respiratory protection, is necessary when cleaning up the spill. Eliminate all sources of ignition immediately. Avoid generation of dust. OPP and SOPP should be collected in suitable and properly labeled containers. See Environmental Information, Health Information, and Physical Hazard Information.

• **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, the material should be captured, collected, and reprocessed, or disposed of according to applicable governmental regulations. A positive-pressure, self-contained breathing apparatus (SCBA) with a full-face mask approved by NIOSH is recommended for emergency work. All sources of ignition should be eliminated immediately and only explosion-proof equipment may be used for the cleanup.
**In case of fire** – Keep people away. Isolate fire and deny unnecessary entry. Cool surroundings with water to localize fire zone. Do not use direct water stream as it may spread fire. Burning liquids may be moved by gently flushing with water to protect personnel and minimize property damage. Water fog, applied gently, may be used as a blanket to extinguish the fire. Contain fire water run-off if possible. Fire water run-off, if not contained, may cause environmental damage. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids. Do not permit dust to accumulate. When suspended in air dust can pose an explosion hazard. Minimize ignition sources. If dust layers are exposed to elevated temperatures, spontaneous combustion may occur. Dense smoke is produced when this product burns. The smoke may contain the original material in addition to combustion products of varying composition, which may be toxic and/or irritating. When relevant in scale or risk, the public should be notified of the hazards associated with the specific release event. See Environmental Information, Health Information, and Physical Hazard Information.

For more information, see the relevant Safety Data Sheet.

**Health Information**

OPP and SOPP have low to moderate acute toxicity if ingested or inhaled. Brief contact with the skin and eyes is very irritating and causes a burn. Inhalation of excessive amounts of material may cause severe irritation to the upper respiratory tract (nose and throat). Prolonged skin contact is unlikely to result in absorption of harmful amounts. OPP and SOPP have not caused allergic skin reactions in animal studies. However, in a small proportion of individuals, skin contact may cause an allergic skin reaction.

OPP and SOPP do not induce birth defects or interfere with reproduction. *In vitro* genetic toxicity studies were negative in some cases and positive in others, but all animal genetic toxicity studies were negative.

The U.S. Environmental Protection Agency has concluded that there is no concern for neurotoxicity resulting from exposure to OPP and SOPP. The available toxicology data on OPP show no significant neurotoxic effects from administration of the chemical in experimental animal studies.

Repeated exposure to OPP and SOPP has shown mild toxicity at high exposure levels. SOPP has been shown to cause bladder tumors when fed at high doses to rats. OPP has been shown to produce urinary bladder tumors in male rats and liver tumors in male mice fed high doses. Under typical use patterns, the long-term risk of human health effects from OPP and SOPP is low.

The Reregistration Eligibility Decision (RED) for OPP and SOPP by the U.S. Environmental Protection Agency (EPA) classified OPP and SOPP as “Not Likely to be Carcinogenic to Humans” based on convincing evidence that carcinogenic effects are not likely below a defined dose range (i.e., below 200 mg/kg/day). As a result, the EPA has established a reference concentration of 39 mg/kg/day that is considered protective for all noncancerous effects and for both bladder and liver tumors for the biocidal applications. The reference concentration is defined as the estimate of exposure that is likely to be without appreciable risk of deleterious health effects for a lifetime. The EPA classified OPP and SOPP as “Likely to be Carcinogenic to Humans” at doses above 200 mg/kg/day.

For more information, see the relevant Safety Data Sheet.
Environmental Information\textsuperscript{1,5,6}

OPP and SOPP are stable in water. However, when exposed to sunlight, OPP in water is susceptible to photolytic degradation. If released to air, OPP degrades due to reaction with hydroxyl radicals. OPP has low mobility in soil and little tendency to volatilize from surface waters or moist soil. The major degradation route appears to be through biodegradation in aerobic and anaerobic environments. OPP and SOPP pass the Organisation for Economic Co-operation and Development (OECD) tests for ready biodegradability. Additional testing by Dow indicates that extensive biodegradation of OPP occurs in wastewater-treatment systems.\textsuperscript{1}

OPP and SOPP are practically nontoxic to birds on a dietary basis. On an acute basis, SOPP is slightly toxic to birds, and OPP is practically nontoxic. OPP and SOPP are highly toxic to aquatic organisms on an acute basis. The most sensitive species tested was the algae \textit{Scenedesmus} sp. These materials should be prevented from entering soil, ditches, sewers, waterways, and/or groundwater.

For more information, see the relevant \textit{Safety Data Sheet}.

Physical Hazard Information\textsuperscript{1,5,6}

Good housekeeping and control of dusts of OPP and SOPP flake materials is necessary since these products may form an explosive dust-air mixture. If dusty atmospheres are encountered, wear a NIOSH-approved air-purifying respirator. An organic vapor cartridge with a particulate prefilter should be an effective air-purifying respirator. Airborne concentrations should be maintained to levels below the recommended Dow Industrial Hygiene Guide of 1 mg/m\textsuperscript{3}. Keep dusts away from sparks and ignition sources.

OPP is readily soluble in most organic solvents and oils and is only slightly soluble in water. It has a low vapor pressure and may release toxic fumes in fire situations. SOPP is readily soluble in water and in many polar organic solvents. The water solubility is pH dependent.

- The addition of SOPP to a water-based formulation will increase the pH due to the presence of residual amounts of sodium hydroxide. Because the solubility of SOPP is affected by pH, measures should be taken to keep the pH of the formulation at 9 or above.
- OPP and SOPP can be formulated with the aid of anionic emulsifiers. However, they are usually incompatible with most other types of surfactants or emulsifiers.

Avoid contact with strong acids and oxidizing materials. Flammable hydrogen may be generated from contact with metals such as aluminum.

For more information, see the relevant \textit{Safety Data Sheet}.

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of OPP and SOPP. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant \textit{Safety Data Sheet}, \textit{Technical Information}, or using \textit{Contact Us}.
Additional Information

- Safety Data Sheets (http://www.dow.com/webapps/msds/msdssearch.aspx)
- Contact Us (http://www.dow.com/biocides/contact/index.htm)
- Product Information (http://www.dow.com/biocides/prod/dowicide.htm)

For more business information about OPP and SOPP, visit the Dow Biocides web site (http://www.dow.com/biocides/)

References

1 *DOWICIDE™ 1 Antimicrobial*, U.S. Material Safety Data Sheet, The Dow Chemical Company.
4 European Chemical Substances Information System (http://ecb.jrc.it/ESIS/), European Chemicals Bureau, search CAS number 90-43-7.
5 *DOWICIDE A Antimicrobial*, Material Safety Data Sheet, The Dow Chemical Company.
8 Unpublished Dow Business Information.
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NOTICES:

Use biocides safely. Always read the label and product information before use.

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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