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NATIONAL PESTICIDE INFORMATION CENTER

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Thank you for visiting the National Pesticide Information Center's fact sheets.

Some of the information in the following fact sheet (scroll down) is out-of-date. NPIC is planning to update this fact sheet in the future. In the meantime, updated information is available on the US EPA's website.

Some of the information in the following fact sheet (scroll down) is out-of-date. NPIC has started a *NEW* set of fact sheets. If you would like to be notified when NPIC releases new publications, send an email to npicupdates@ace.orst.edu with "subscribe" in the subject line.

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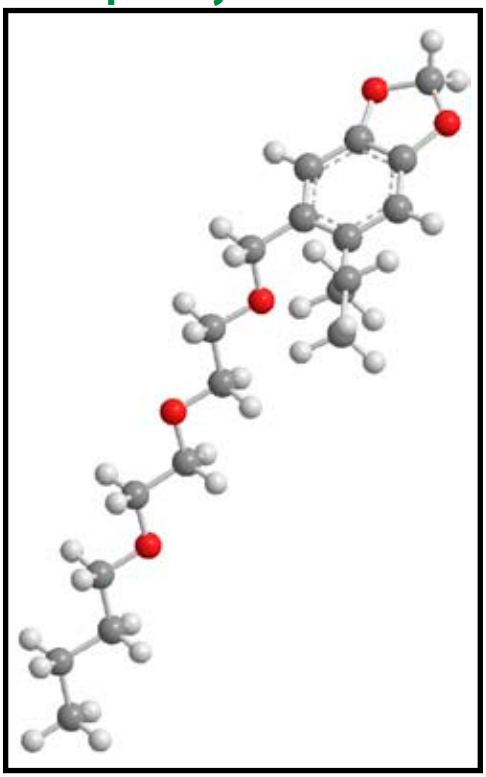
Please call NPIC with any questions you have about pesticides at **1-800-858-PEST (7378)**.

Molecular Structure - Piperonyl Butoxide



NPTN General Fact Sheets are designed to answer questions that are commonly asked by the general public about pesticides that are regulated the U.S. Environmental Protection Agency (US EPA). This document is intended to be helpful to professionals and to the general public for making decisions about pesticide use.

National Pesticide Telecommunications Network

Piperonyl Butoxide

(General Fact Sheet)

Please refer to the **Technical Fact Sheet** for more technical information.

The Pesticide Label: Labels provide directions for the proper use of a pesticide product. *Be sure to read the entire label before using any product.* A signal word, on each product label, indicates the product's potential hazard.

CAUTION - low toxicity **WARNING - moderate toxicity** **DANGER - high toxicity**

What is piperonyl butoxide?

- Piperonyl butoxide is a synergist used in a wide variety of pesticides (1). Synergists are chemicals that lack pesticidal effects of their own but enhance the pesticidal properties of other chemicals (2). Piperonyl butoxide is used in pesticides containing chemicals such as pyrethrins, pyrethroids, rotenone, and carbamates (1, 3). See the **Pesticide Label** box above.

- Researchers developed piperonyl butoxide in 1947 using naturally-occurring safrole as a key raw material (1, 3).

- Piperonyl butoxide is a colorless to pale yellow liquid. It does not dissolve in water and is stable to breakdown by water and ultraviolet light. Researchers consider piperonyl butoxide to be noncorrosive (4).

How does piperonyl butoxide work?

- Piperonyl butoxide inhibits breakdown of pesticides by insects (3, 5). Without piperonyl butoxide, an insect may degrade a pesticide before an effect can occur. The addition of piperonyl butoxide to a pesticide reduces the amount of pesticide required to be effective (2).

What types of products contain piperonyl butoxide?

- Pesticides for indoor home use such as dusts, sprays, and foggers
- Pesticides for gardens, lawns, and decorative plants
- Agricultural pesticides for food and nonfood crops
- Mosquito control products
- Termite treatments
- Veterinary pesticide products
- Animal ear tags and pest strips
- Pesticides for human clothing, bedding, and mattresses

How toxic is piperonyl butoxide?

Exposure: Effects of piperonyl butoxide on human health and the environment depend on how much piperonyl butoxide is present and the length and frequency of exposure. Effects also depend on the health of a person and/or certain environmental factors.

Laboratory Testing: Before pesticides are registered by the U.S. EPA, they must undergo laboratory testing for short-term (acute) and long-term (chronic) health effects. Laboratory animals are purposely fed high enough doses to cause toxic effects. These tests help scientists judge how these chemicals might affect humans, domestic animals, and wildlife in cases of overexposure. When pesticide products are used according to the label directions, toxic effects are not likely to occur because the amount of pesticide that people and pets may be exposed to is low compared to the doses fed to laboratory animals.

Animals

- Piperonyl butoxide is low to very low in toxicity when eaten by mammals (6). See boxes on **Laboratory Testing**, **LD50/LC50**, and **Toxicity Category**.
- Piperonyl butoxide is very low in toxicity when inhaled by rats (6, 7).
- Piperonyl butoxide is low to very low in toxicity to mammals when absorbed by the skin (3, 6, 7). Guinea-pigs exposed to piperonyl butoxide showed no signs of skin sensitivity (7).
- Researchers exposed the eyes of rabbits to piperonyl butoxide and all eye irritations that developed fully recovered (7).
- The liver is the target organ for piperonyl butoxide (6).
- Researchers applied piperonyl butoxide to the skin of male and female rabbits for three weeks. They noted skin redness and swelling at the application sites (6).
- Researchers fed dogs capsules containing piperonyl butoxide for one year. All dogs dosed at the highest level died; those dosed at the lowest level exhibited no effects (6, 7, 8).

Humans

- Researchers gave eight male human volunteers, aged 22 to 57, a single oral dose of piperonyl butoxide. They monitored the volunteers for 31 hours and observed no changes in the volunteers' metabolism (3, 6).

Toxicity Category (*Signal Word*) (9)

	High Toxicity (*Danger*)	Moderate Toxicity (*Warning*)	Low Toxicity (*Caution*)	Very Low Toxicity (*Caution*)
Oral LD50	Less than 50 mg/kg	50 - 500 mg/kg	500 - 5000 mg/kg	Greater than 5000 mg/kg
Dermal LD50	Less than 200 mg/kg	200 - 2000 mg/kg	2000 - 5000 mg/kg	Greater than 5000 mg/kg
Inhalation LC50	Less than 0.05 mg/l	0.05 - 0.5 mg/l	0.5 - 2 mg/l	Greater than 2 mg/l
Eye Effects	Corrosive	Irritation persisting for 7 days	Irritation reversible within 7 days	Minimal effects, gone within 24 hrs
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation

LD50/LC50: A common measure of acute toxicity is the lethal dose (LD50) or lethal concentration (LC50) that causes death (resulting from a single or limited exposure) in 50 percent of the treated animals. LD50 is generally expressed as the dose in milligrams (mg) of chemical per kilogram (kg) of body weight. LC50 is often expressed as mg of chemical per volume (e.g., liter (L)) of medium (i.e., air or water) the organism is exposed to. Chemicals are considered highly toxic when the LD50/LC50 is small and practically non-toxic when the value is large. However, the LD50/LC50 does not reflect any effects from long-term exposure (i.e., cancer, birth defects, or reproductive toxicity) that may occur at levels below those that cause death.

- Researchers applied a commercial pesticide that contained piperonyl butoxide to the forearms of human volunteers. The volunteers showed no evidence of toxicity (10).

Does piperonyl butoxide cause reproductive or birth defects?

Animals

- Researchers fed male and female rats piperonyl butoxide before the rats mated. They continued feeding them the chemical during mating, pregnancy, and nursing periods. Researchers detected no negative reproductive effects on the rats. They did detect that both adult and young rats that were fed the highest doses of the chemical had lower body weights (7).

- The offspring of pregnant rats that were fed piperonyl butoxide through stomach tubes did not have birth defects (6, 7).

Humans

- Data are not available from accidental poisonings, work-related exposures, or other human studies regarding the reproductive and developmental toxicity of piperonyl butoxide.

Does piperonyl butoxide cause cancer?

Animals

- Researchers detected an increased occurrence of liver tumors at the highest dose tested in male and female mice fed diets containing piperonyl butoxide (6, 7, 11). Researchers consider the mice tumors a low hazard and unlikely to represent a human cancer risk from piperonyl butoxide exposure (11).

- Researchers observed no evidence of cancer in male and female rats fed diets containing piperonyl butoxide (6, 7, 11).

- Researchers often test chemicals for their ability to change the genetic material of an organism as an indication of their potential to cause cancer. Evidence exists that piperonyl butoxide does not change genetic material (6, 7, 12).

Humans

- The U.S. EPA classifies piperonyl butoxide as a group C carcinogen (13). This means that piperonyl butoxide is considered a possible human carcinogen based on limited evidence of cancer in laboratory animals. See box on **Cancer**.

- Data are not available from work-related exposures or other human studies regarding the ability of piperonyl butoxide to cause cancer.

Cancer: The U.S. EPA has strict guidelines that require testing of pesticides for their potential to cause cancer. These studies involve feeding laboratory animals large *daily* doses of the pesticide over most of the lifetime of the animal. Based on these tests, and any other available information, EPA gives the pesticide a rating for its potential to cause cancer in humans. For example, if a pesticide does not cause cancer in animal tests at large doses, then the EPA considers it unlikely the pesticide will cause cancer in humans. Testing for cancer is not done on human subjects.

What happens to piperonyl butoxide in the environment?

- Researchers evaluated the disappearance of piperonyl butoxide in soil and water and determined that the chemical is short-lived in the environment. Piperonyl butoxide has a moderate to low potential to contaminate groundwater (14).

- Piperonyl butoxide released as a liquid in the air is removed by settling to the ground. When released as a gas, piperonyl butoxide rapidly degrades in air (15).

What effects does piperonyl butoxide have on wildlife?

- Researchers consider piperonyl butoxide moderately toxic to fish and highly toxic to other aquatic organisms. It is not likely to accumulate in fish (16).

- Piperonyl butoxide is low to very low in toxicity when eaten by birds (16).

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