This fact sheet was created in 2001; some of the information may be out-of-date. NPIC is not planning to update this fact sheet. More pesticide fact sheets are available here. Please call NPIC with any questions you have about pesticides at 800-858-7378, Monday through Friday, 8:00 am to 12:00 pm PST.

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

Potassium Salts of Fatty Acids

(Technical Fact Sheet)

For less technical information, please refer to the General Fact Sheet

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 are potassium salts of fatty acids?

- Potassium salts of fatty acids are commonly called soap salts. They are used as insecticides, herbicides, fungicides, and algaecides. The first pesticide product containing soap salts was registered for use in 1947 (1).

- Potassium salts of fatty acids are produced by adding potassium hydroxide to fatty acids found in animal fats and in plant oils. Fatty acids are extracted from palm, coconut, olive, castor, and cottonseed plants to form this active ingredient (2).

- Soap salts are derived from fatty acids with carbon chain lengths of 12-18 saturated carbons, and chain lengths of 18 carbons with one or more double bonds (unsaturated). Potassium salts may include oleate, laureate, myristate, and ricinoleate (1).

- Some potassium salts of fatty acids are used as multi-purpose food additives. The Food and Drug Administration (FDA) classifies them as GRAS (generally recognized as safe) (3).

- Residues from the use of this active ingredient, in accordance with labeling guidelines, are not anticipated to exceed levels that occur naturally, or levels that are intentionally added to food. Potassium salts of fatty acids have been exempt from United States Environmental Protection Agency (EPA) tolerances for food and feed crops since 1982 (1,4).

- Except for basic product identity, chemical studies, and acute ecotoxicity studies, the EPA waived toxicology requirements under 40 CFR Part 158 for potassium salts of fatty acids and relied on published data (1).

What are some products that contain potassium salts of fatty acids?

- Safer Agro-Chem.s Insecticidal Soap®
- Safer Moss and Algae Attack Concentrate®
- Safer Sharpshooter Weed and Grass Killer Concentrate®
- M-Pede Insecticide/Fungicide®

What is the mode of action of potassium salts of fatty acids?

- Potassium salt formation provides water solubility for the fatty acids. The lipophilic carbon chains of the fatty acids penetrate and disrupt the lipoprotein matrix of the insects cellular membranes. The membrane disruption leads to evacuation of cellular contents, causing the cell to dehydrate and die. Fatty acid toxicity increases with increasing carbon chain length, typically peaking at C_{10}, and then decreasing. Fatty acid chain lengths of 18 carbons with one or two double bonds (unsaturated) also display insecticidal activity (5, 6).

- Potassium salts of fatty acids are relatively selective in toxicity based on the insect species and stage of development. Soft bodied insects such as aphids, whiteflies, and mealy bugs are more susceptible to desiccation. The least affected are flying adult insects with more durable exteriors, such as ladybird beetles. However, insects in the immature, flightless stage of development are more vulnerable to the effects of this active ingredient (5, 7).

    - Potassium salts of fatty acids may be phytotoxic to some plant species. Plants with hairy leaves, such as *Echium*, may retain the soap on their surfaces longer, resulting in a burn (7, 8).

- Potassium salts of fatty acids can also be fungicidal. As with its insecticidal activity, fungicidal effects increase with additional carbon chain lengths. Greatest toxic effects occur at C_{10} or C_{11} then decrease. Unsaturated fatty acids with 18 carbon chain lengths do not appear to be fungicidal (5, 9).

Laboratory Testing: Before pesticides are registered by the U.S. EPA, they must undergo laboratory testing for short-term and long-term 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.

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.

How toxic are potassium salts of fatty acids?

Animals

- Fatty acids and their potassium salts are very low in toxicity via the oral route. When administered to rats, the oral LD50 of oleic acid was 74,000 mg/kg (1). See boxes on **Laboratory Testing, LD50/LC50,** and **Toxicity Category**.

- Potassium salts of fatty acids are low to very low in toxicity by skin exposure. Scientists applied 10 mg of soap salts to the skin of rabbits and noted mild irritation. Scientists also noted eye irritation after they applied 12 mg of potassium salt of oleic acid to the rabbits eyes (1).

Humans

- Soaps have a detectable and unpleasant odor that typically limits exposure. High oral doses can cause general stomach upset and vomiting in humans but do not cause serious systemic effects (1, 7).

Toxicity Category (*Signal Word*) (10)

	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

- Potassium salts of fatty acids may cause mild to moderate skin irritation with prolonged contact. Scientists applied 2.5 mg of soap to human skin for 24 hours and observed moderate irritation (1).

Do potassium salts of fatty acids cause reproductive or teratogenic effects?

- Researchers administered potassium salts of coco fatty acids to mice on days 2-13 of pregnancy. An effect on post-implantation mortality was observed at 6,000 mg/kg, and musculo-skeletal system abnormalities were noted at 600 mg/kg (1).

- Scientists observed potassium salts of fatty acids to cause non-lethal developmental effects in insects in the immature stage of development (7).

- The use of potassium salts of fatty acids in accordance with labeling guidelines is not expected pose any significant hazards to humans (1).

Do potassium salts of fatty acids break down and leave the body?

- Fatty acids constitute part of a normal diet and are readily metabolized as an energy source for living cells (1, 5).

What is the environmental fate and behavior of potassium salts of fatty acids?

- Potassium salts of fatty acids are naturally occurring and are not persistent in the environment. The estimated soil half-life is less than one day. Microbial organisms in the soil rapidly degrade this active ingredient (1). See box on **Half-life**.

Half-life is the time required for half of the compound to degrade.

1 half-life	**=**	**50% degraded**
2 half-lives	**=**	**75% degraded**
3 half-lives	**=**	**88% degraded**
4 half-lives	**=**	**94% degraded**
5 half-lives	**=**	**97% degraded**

Remember that the amount of chemical remaining after a half-life will always depend on the amount of the chemical originally applied.

What effect do potassium salts of fatty acids have on wildlife?

- Birds, mammals, and invertebrates ingest fatty acids as a significant part of their normal diet (1).

- Scientists administered a single oral dose of potassium salts of fatty acids to bobwhite quail and mallard ducks. LD50 values were >2,000 mg/kg and >2,510 mg/kg, respectively. Scientists also administered potassium salts of fatty acids to bobwhite quail and mallard ducks in an 8-day sub-acute dietary study. LD50 values were >5,620 mg/kg and >5,620 mg/kg, respectively. Scientists concluded that potassium salts of fatty acids are relatively non-toxic to birds (1).

- Potassium salts of fatty acids were administered to freshwater fish in separate 96-hour studies. Researchers used rainbow trout and bluegill sunfish. LC50 values were 18.06 ppm and 35.5 ppm, respectively. Scientists concluded that potassium salts of fatty acids are slightly toxic to cold-water and warm-water fish (1).

- Potassium salts of fatty acids are highly toxic to aquatic invertebrates. The LC50 was determined to be 0.57 ppm in a 48-hour acute toxicity study with *Daphnia magna*. The EPA requires all product labels containing this active ingredient to state that the product is not to be applied directly to water and the user is not to contaminate water by cleaning equipment or disposing of wash water that contains potassium salts of fatty acids (1, 11).

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