

5. PRODUCTION, IMPORT/EXPORT, USE, AND DISPOSAL

5.1 PRODUCTION

Information regarding the manufacturers of various pyrethrins and pyrethroids in the United States is given in Table 5-1 (SRI 2000). Table 5-2 lists the number of facilities in each state that produce, process, or import pyrethrins and pyrethroids for commercial use. The intended use and the range of maximum amounts of these substances that are stored on site are also included. The data listed in these tables are derived from the Toxics Release Inventory (TRI99 2001). Only certain types of facilities were required to report, and this is not an exhaustive list. The only pyrethroids that are on the list are allethrin, bifenthrin, cyfluthrin, cyhalothrin, fenpropathrin, fluvalinate, permethrin, phenothrin, resmethrin, and tetramethrin (TRI99 2001). Furthermore, data have only been reported for bifenthrin, cyfluthrin, permethrin, resmethrin, and tetramethrin. No data regarding the production volumes are available.

Naturally-occurring pyrethrins are produced by certain species of chrysanthemum plants (*Chrysanthemum cinerariaefolium* and *Chrysanthemum cinereum*). Either the flowers are dried and powdered or the oils within the flowers are extracted with solvents such as petroleum ether, acetone, or acetic acid (Metcalf 1995). Synthetic pyrethroids are manufactured by the esterification of an appropriate acid with an appropriate alcohol (Table 5-3).

Technical-grade (concentrated) pyrethroids are usually formulated for use in commercial products. The formulated product may contain up to 99% inert (“secret”) ingredients that improve storing, application handling, or effectiveness. The EPA publishes a complete list of all inert ingredients found in pesticide products registered in the United States, and categorizes them along the following four classes: (1) inert ingredients of toxicological concern; (2) potentially toxic inert ingredients; (3) inert ingredients of unknown toxicity; and (4) inerts of minimal concern (EPA 2003). Even though the EPA publishes a list of all inert ingredients used in currently registered pesticides, it does not specify which ingredients are contained in any specific formulated product, and federal law does not require the pesticide label to identify the inert ingredients unless they are categorized as class one inert ingredients. A common formulation used in pyrethrin and pyrethroid products is an emulsifiable concentrate (EC). The primary inert ingredients in a pesticide product formulated as an EC are an emulsifier and a petroleum solvent, such as kerosene. Other popular formulations are aerosol dispenser (AE), wettable powder (WP), dustable powder (DP), and water dispersible granules (WG) (Tomlin 1997).

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Table 5-1. U.S. Producers of Pyrethrins and Pyrethroids

Pyrethroid	Producer	Production site
Bifenthrin	FMC Corporation	Baltimore, Maryland
Cyfluthrin	Bayer Corporation	Kansas City, Missouri; Shawnee, Kansas
Cypermethrin	Astra Zeneca	Cold Creek, Alabama
	FMC Corporation	Baltimore, Maryland
Esfenvalerate	Du Pont	Axis, Alabama
Fluvalinate	BASF Corporation	Beaumont, Texas
Permethrin	Astra Zeneca	Cold Creek, Alabama
	FMC Corporation	Baltimore, Maryland
Pyrethrins (Pyrethrum)	McLaughlin Gormley King	Chaska, Minnesota
	SureCo Incorporated	Fort Valley, Georgia

Source: SRI 2000

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Table 5-2. Facilities that Produce, Process, or Use Pyrethroids

State ^a	Number of facilities	Minimum amount on site in pounds ^b	Maximum amount on site in pounds ^b	Activities and uses ^c
Bifenthrin				
FL	1	100,000	999,999	8
IL	1	10,000	99,999	8
TX	1	10,000	99,999	2, 3, 8
Cyfluthrin				
MO	1	100,000	999,999	8
TX	1	10,000	99,999	8
Permethrin				
AL	1	100,000	999,999	1, 4
AR	1	10,000	99,999	8
FL	1	1,000,000	9,999,999	8
GA	1	100,000	999,999	8
IL	1	10,000	99,999	8
LA	1	1,000	9,999	8
MD	1	1,000,000	9,999,999	1, 4
NJ	1	1,000	9,999	8
TN	1	10,000	99,999	8
TX	2	10,000	99,999	2, 3, 8, 10
WI	1	10,000	99,999	8
Resmethrin				
TX	1	10,000	99,999	8
Tetramethrin				
WI	1	10,000	99,999	8

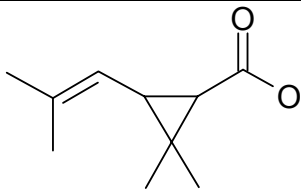
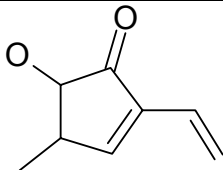
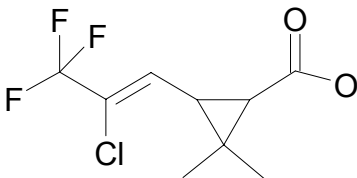
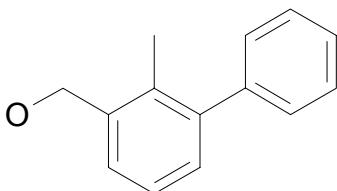
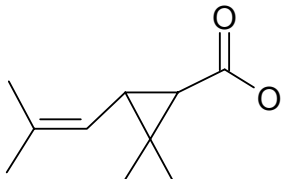
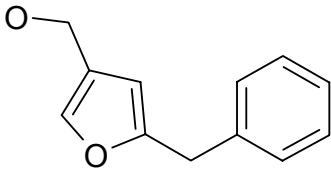
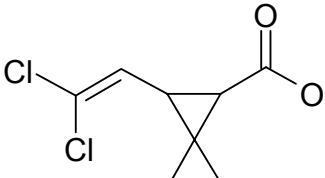
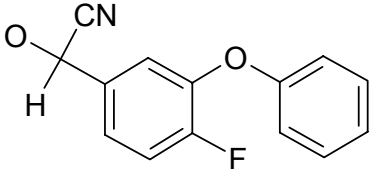
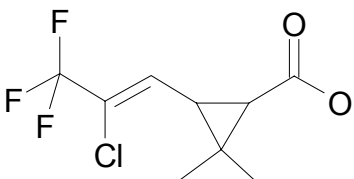
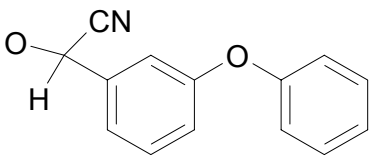
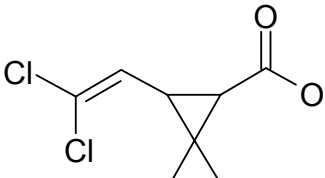
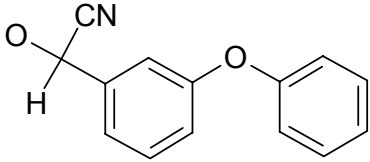
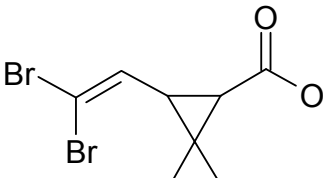
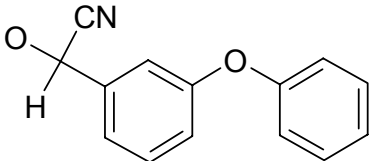
^aPost office state abbreviations used^bAmounts on site reported by facilities in each state^cActivities/Uses:

- | | | |
|--------------------------|--------------------------|-----------------------------|
| 1. Produce | 6. Impurity | 10. Repackaging |
| 2. Import | 7. Reactant | 11. Chemical Processing Aid |
| 3. Onsite use/processing | 8. Formulation Component | 12. Manufacturing Aid |
| 4. Sale/Distribution | 9. Article Component | 13. Ancillary/Other Uses |
| 5. Byproduct | | |

Source: TRI99 2001

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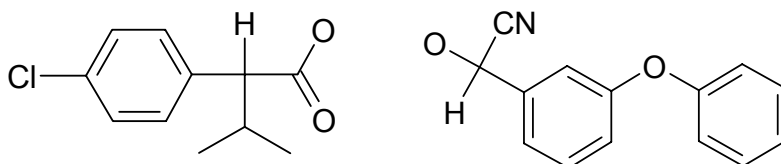
Table 5-3. Acid and Alcohol Feedstocks in the Pyrethroids Synthesis

Pyrethroid	Acid	Alcohol
Allethrin		
Bifenthrin		
Bioresmethrin		
Cyfluthrin		
Cyhalothrin		
Cypermethrin		
Deltamethrin		

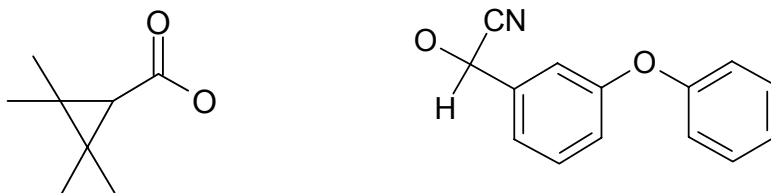
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Table 5-3. Acid and Alcohol Feedstocks in the Pyrethroids Synthesis

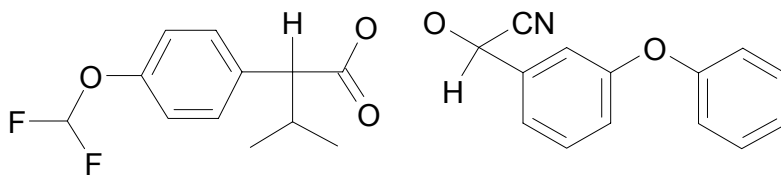
Esfenvalerate



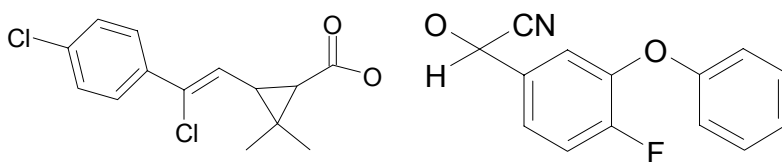
Fenproparthrin



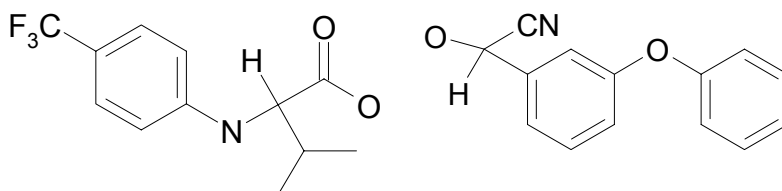
Flucythrinate



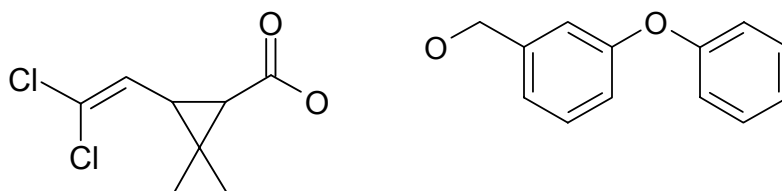
Flumethrin



Fluvalinate



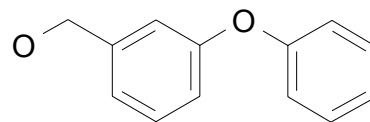
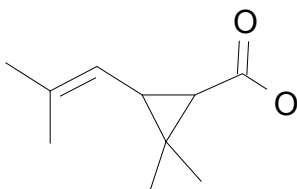
Permethrin



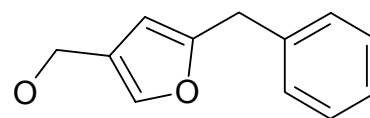
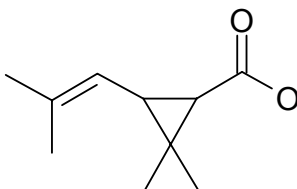
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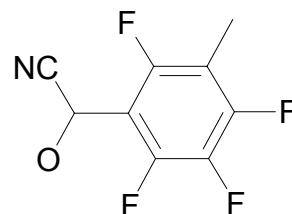
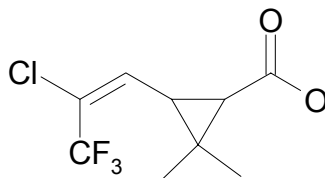
Phenothrin



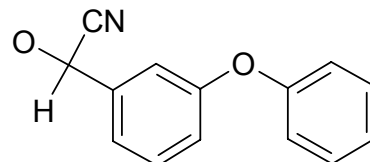
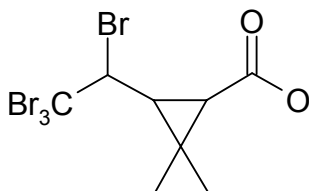
Resmethrin



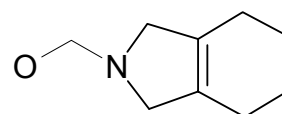
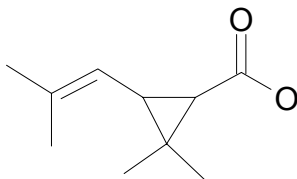
Tefluthrin



Tralomethrin



Tetramethrin



Source: HSDB 2001

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5.2 IMPORT/EXPORT

No data regarding the import or export volumes of pyrethrins and pyrethroids are available.

5.3 USE

Naturally-occurring pyrethrins were first used around 1800 in the Transcaucasus region of Asia to control human lice, mosquitoes, cockroaches, beetles, and flies. Pyrethroids are broad-spectrum insecticides, effective against a wide range of flying, crawling, chewing, and sucking insects of the orders *Coleoptera*, *Diptera*, *Hemiptera* (*Homoptera* and *Heteroptera*), *Hymenoptera*, *Lepidoptera*, *Orthoptera*, and *Thysanoptera*. They are used as household insecticides, as grain protectants, and to control pests on edible products just prior to harvest (Metcalf 1989). They are used in a variety of locations including residential, public, and commercial buildings, animal houses, warehouses, fields, and green houses. They are also extensively used in the field of veterinary medicine (Davies 1985).

All concentrated formulations of pyrethroids were classified as restricted use pesticides by the EPA in 1995 (EPA 2000a). This classification restricts a pesticide to be used only by a certified applicator, or under the direct supervision of a certified applicator. Detailed information regarding the amounts applied and use of individual pyrethroids is provided in Table 5-4. The data shown in Table 5-4 were developed from state-wide estimates of pesticide use rates on cropland and do not include pesticide applications to noncropland areas (i.e., home use, greenhouse use, etc.).

5.4 DISPOSAL

All pyrethrins and pyrethroids as well as piperonyl butoxide are listed as toxic substances under Section 313 of the Emergency Planning and Community Right to Know Act (EPCRA) under Title III of the Superfund Amendments and Reauthorization Act (SARA) (EPA 1995). Disposal of wastes containing these compounds is controlled by a number of federal regulations (see Chapter 8). According to the TRI, in 1999, an estimated 1,239 pounds of permethrin were transferred off-site, presumably for disposal (TRI99 2001). No other pyrethroids or pyrethrins were reported as having off-site transfers in 1999 (TRI99 2001).

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Table 5-4. Uses of Pyrethroids

Pyrethroid	Amount ^a (pounds)	Insects ^{b,c,d}	Crops ^{b,c,d}	Other locations and applications ^{b,c}
Allethrin	NA	Flies, mosquitoes, ants	N/A	Residential, public health, animal houses, topical application in pet sprays and shampoos NA
Bifenthrin	114,377	Beetles, weevils, houseflies, mosquitoes, lice, bedbugs, aphids, moths, cockroaches, locusts	Alfalfa hay, beans, cantaloupes, cereals, corn, cotton, field and grass seed, hops, melons, oilseed rape, potatoes, peas, raspberries, watermelons, squash	NA
Bioresmethrin	NA	Houseflies, mosquitoes, cockroaches	NA	Household, public health, animal houses Green houses
Cyfluthrin	151,422	Aphids, cabbage stem flea beetle, cockroaches house flies, mosquitoes, rape winter stem weevil	Alfalfa, cereals, cotton, citrus, deciduous fruit, ground nuts, maize, oilseed rape, pears, potatoes, rice, sugar beet, sugarcane, tobacco, vegetables	Green houses
Cyhalothrin	NA	Bedbugs, beetles, houseflies, ked, lice, mosquitoes, moths, weevils	N/A	Public health, animal houses, inert surfaces
Cypermethrin	215,066	Cockroaches, flies, mosquitoes, moths	Cotton, lettuce, onions, pears, peaches, pecans, sugar beets	Residential and commercial buildings, animal houses
Deltamethrin	NA	Aphids, beetles, boll- worm, bud-worm, caterpillars, cicadas, codling moths, tortrix moths, weevils, whitefly, winter moths	Alfalfa, beet, cereals, coffee, cotton, figs, fruits, hops, maize, oilseed rape, olives, oil palms, potatoes, rice, soybeans, sunflowers, tea, tobacco, vegetables	Forests, households, animal houses, stored products
Esfenvalerate	215,919	Beetles, moths	Cabbage, corn, cotton, fruit trees, grains, groundnuts, maize, pecan, potatoes, sorghum, soybeans, sugar cane, sunflowers, sweet corn, tomatoes, vegetables, wheats	Ornamentals, non- crop land

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Table 5-4. Uses of Pyrethroids

Pyrethroid	Amount ^a (pounds)	Insects ^{b,c,d}	Crops ^{b,c,d}	Other locations and applications ^{b,c}
Fenproparthrin	146,707	Aphids, armyworms, bollworms, bud-worms, cabbage looper, cabbage-worms, cutworms, diamondback moth, fruit moths, leaf-miners, leafrollers, leaf-worms, lepidopterous larvae, mites, mosquito, psyllas, stem-borers, ticks, tortrixies, tuber-worms, whiteflies	Cotton, citrus, fruits, pome, tomatoes, vegetables, vines	Glasshouse, ornamental trees
Flucythrinate	NA	Boll-worms, leaf-worms, sucking insects, whiteflies, beetles	Cotton, vines, strawberries, citrus fruit, bananas, pineapples, olives, coffee, cocoa, hops, vegetables, soybeans, cereals, maize, alfalfa, sugarbeet, sunflowers, tobacco	NA
Flumethrin	NA	Lice, ticks, psoroptic, chorioptic and sarcoptic munge	NA	NA
Fenvalerate	61,582	Beetles, cockroaches, flies, locusts, mosquitos, moths	Alfalfa hay, apples, beet, cereals, cotton, corn, cucurbita, fruit, green beans, groundnuts, hops, maize, nuts, oilseed rape, olives, potatoes, sorghum, soybeans, squash, sugarcane, sunflower, vegetables, vines, tobacco	Ornamentals, forestry, non-crop land
Fluvalinate	NA	Aphids, leaf-hoppers, moths, spider mites, thrips, white-flies	Apples, cereals, cotton, pears, peaches, tobacco, vegetables, vines	Outdoor and indoor ornamentals, turf
Permethrin	1,055,097	Ants, beetle, boll-worm, bud-worm, fleas, flies, lice, moths, mosquitos, termites, weevils	Alfalfa hay, corn, cotton, grains, lettuce, onion, peaches, potatoes, sweet corn, tomatoes, wheat	Home gardens, green houses, pet sprays, and shampoos
Phenothrin	NA	Ants, bedbugs, cockroaches, fleas, houseflies, lice, mosquitoes, ticks	NA	Public buildings, stored grain, pet sprays, and shampoos
Resmethrin	NA	Flying and crawling insects, mosquitos houseflies, german cockroaches	NA	Homes, greenhouses, indoor landscapes, mushroom houses, industrial sites

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Table 5-4. Uses of Pyrethroids

Pyrethroid	Amount ^a (pounds)	Insects ^{b,c,d}	Crops ^{b,c,d}	Other locations and applications ^{b,c}
Tefluthrin	423,973	Beetles, houseflies, mosquitoes moths, weevils	Corn, maize, sugar beet, sweet corn	NA
Tetramethrin	NA	Flies, cockroaches, mosquitoes, wasps	NA	Public health, home and garden use
Tralomethrin	53,331	Aphids, beetles, cockroaches, moths, weevils	Cereals, coffee, cotton, fruit, maize, oilseed rape, rice, soybeans, tobacco, vegetables	Wood protection, homes, public health, stored grain, animal houses

^aUSGS 2001^bHSDB 2001^cMetcalf 1995^dTomlin 1997

N/A = not available

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The EPA Office of Pesticide Programs has detailed labels for the use, storage, and disposal of all pesticides, including registered products containing pyrethrins and pyrethroids. All pesticide products are required to bear instructions for the storage and disposal of the pesticides and the pesticide containers. Storage and disposal instructions cover the appropriate storage of the pesticide product; disposal of any unused pesticide product or any rinse liquids resulting from cleaning of pesticide application equipment; and the disposal of the pesticide container. State and local regulations may be stricter than the federal requirements listed on the label.

