

Safe Alternatives to Toxic Mothballs

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STORY AT-A-GLANCE

- › In earlier times, mothballs were commonly added to storage bins, boxes and trunks to prevent clothing made from natural fibers from becoming infested with moth larvae
- › Mothballs contain toxic chemicals, namely naphthalene and paradichlorobenzene, which are unsafe for people, pets and wildlife
- › Several safe alternatives exist to the use of mothballs, including cedar blocks or chips and essential oils such as lavender, mint and white camphor

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Prior to the mass production of synthetic fabrics such as polyester, mothballs were commonly added to bins, boxes and trunks to prevent stored clothing made from natural fibers from becoming infested with clothes moths (*Tineola bisselliella*). Perhaps you remember visiting the home of an elderly relative whose attic or basement smelled strongly of mothballs. It's an unforgettable odor and one that can be toxic with continuous exposure.

Even though people today wear fewer natural fabrics, such as wool, mothballs are still in high demand. While they were once used almost exclusively to prevent moths from attracting stored clothing, mothballs are now mostly misused to deter pests found in attics, backyards and gardens. A far better solution to moth control is the use of essential oils, such as lavender, mint and white camphor oil.

Who Regulates Mothballs and What's in Them?

In the U.S., mothballs are regulated by the Environmental Protection Agency (EPA). Currently, more than 30 products are registered with the EPA that contain paradichlorobenzene, as well as more than a dozen products that contain naphthalene.¹ Notably, the European Union (E.U.) banned the supply of all naphthalene-containing products in 2008, due to concerns about toxicity.²

Pesticide labels, including labels for mothballs, detail exactly where and how you can use the product legally. Using mothballs in ways beyond what is recommended on the label is not only illegal, but can be harmful to people, pets and the environment.³ For example, mothballs are sometimes used in gardens to deter digging rodents. Tim Stock, Oregon State University's (OSU) Integrated Pest Management director, said:⁴

"People often use mothballs in inappropriate sites and against incorrect pests. The only recommendation that counts is the product label, which is a legal document whose instructions must be followed – particularly on where mothballs may be used and which pests they will control."

Stock and Dave Stone, Ph.D., associate dean of international programs at OSU, co-wrote an article entitled "Mothballs: Proper Use and Alternative Controls for Clothes Moths."⁵

Stone says mothballs should not be used inside attics, crawl spaces, gardens, trash cans or vehicles. "Often, mothballs are used in these locations to control pests other than clothes moths," he says. Some of the wild pests Stone mentioned are deer, mice, moles, raccoons, squirrels and skunks. He suggested that domesticated cats and dogs have also been targets for mothballs. All such animal applications are illegal, and sometimes dangerous, said Stone.⁶

"A relatively common mistake is placing mothballs in an attic to repel squirrels. This will almost always result in a persistent and noxious odor throughout the home."

How the Toxic Ingredients in Mothballs Can Affect Your Health

In the past, mothballs were made from plant-based camphor and, later, naphthalene, a derivative of coal tar. Because naphthalene is highly flammable, mothballs are also fashioned from the synthetic chemical paradichlorobenzene, which has an unpleasant smell but is cheaper to make.⁷

Today's mothballs — bars, cakes, crystals, flakes and tablets — contain either naphthalene or paradichlorobenzene as nearly 100% active ingredients.⁸ When you inhale the odor of mothballs, you are actually inhaling a pesticide. According to Stone:⁹

"Both chemicals are fumigants, meaning that their volatile chemicals will vaporize at lower temperatures, such as room temperature. Naphthalene has been associated with adverse health effects such as headache, nausea, dizziness and difficulty breathing. Paradichlorobenzene is also a potential hazard, although typically less than naphthalene."

Because naphthalene and paradichlorobenzene transition from a solid straight to a gas, a process called sublimation, it is their toxic fumes that kill moths and moth larvae.¹⁰

In addition to the concerns noted above, I would add that paradichlorobenzene has been found to cause cancer in animals. Prolonged exposure to naphthalene can damage or destroy your red blood cells, which may cause diarrhea, nausea and vomiting. Due to the potential side effects, it is essential that you follow all label instructions and take steps to limit your exposure to naphthalene and paradichlorobenzene, whether in mothballs or other household products.

How to Properly Use Mothballs

The key to success with mothballs is to place them with your stored items in an airtight, sealed container. Inside a sealed container, the fumes become concentrated, thereby killing the moths. With this arrangement, because the fumes are contained, mothballs

are purported to not be harmful to people. You do face risks of toxic exposure and potential health problems, however, if you:^{11,12}

- Store items with mothballs in containers that are not tightly sealed, because fumes will be released into the air and could accumulate in living areas inhabited by humans and pets
- Use mothballs in gardens or other outdoor areas to control insects, rodents or snakes because of potential contamination to air, soil, plants and water supplies
- Leave mothballs out and within reach of children and pets who may ingest them
- Wash clothes that have been stored with mothballs immediately after removing them from the storage containers

It's important to note that due to their smaller size, infants can easily be overcome by toxic exposure from clothing treated with mothballs.¹³ Never put clothing that has been stored in mothballs on your baby until the items have been aired out and washed properly. If possible, store infant clothing separately and use one of the nontoxic alternatives to mothballs that will be discussed later.

As you might imagine, children, pets and wildlife can easily mistake mothballs as food and chew or swallow them. If someone has ingested a mothball, call the American Association of Poison Control Centers at 1-800-222-1222 or seek emergency medical assistance. If you think your pet may have eaten a mothball, contact your veterinarian.

Safer Ways to Prevent Moth Damage

The Spruce offers several helpful suggestions to prevent moth damage without resorting to toxic mothballs:¹⁴

- Machine wash or dry clean your clothing prior to storing it at the end of the season to kill any larvae that may have attached to the clothing prior to storage
- Store your items in sealed containers such as chests, plastic storage containers or suitcases; zip wool coats and suits into garment bags

- Since moths prefer moist environments, be sure to store your items in a closet or under your bed; avoid storing clothing for long periods of time in your basement or garage

While prevention strategies are the best defense against clothing moths, Stock offers tips on what to do if you are dealing with a moth infestation:¹⁵

"... Vacuum drawers and closets using a HEPA vacuum cleaner. Also, vacuum furniture and other places that provide food sources such as lint, pet hair and human hair. Lint and hair that have been undisturbed for a long time are prime breeding grounds for clothes moths."

Be sure to change your vacuum bag regularly to ensure you are removing the larvae from your home and not giving them a chance to repopulate. If you find moths on clothing or other textiles, place the affected item in the freezer for at least 24 hours to kill any active larvae.

How to Get Rid of Moths Naturally

The Apartment Therapy website features an easy do-it-yourself project on how to make a moth-repellent sachet using dried herbs.¹⁶ Most health food stores sell dried herbs in bulk. In addition to following the suggestions given above, you can eliminate and prevent clothes moths with one or more of the following natural remedies:¹⁷

- **Cedar** — Cedar blocks, chips, chests or closets have long been recognized as an effective moth repellent. Keep in mind that cedar loses its scent and repellent effectiveness over time, and you'll need to periodically sand the wood lightly or apply cedar oil to re-establish the scent
- **Cloves, rosemary and thyme** — Place a mix of these dried herbs in one or more sachet bags and add them to the storage containers with your clothing; replace the contents of the sachets every six months or whenever they lose their fragrance
- **Lavender** — Fill one or more sachet bags with dried lavender, or dip several cotton balls in [lavender essential oil](#), then place them in airtight storage containers with

your clothes

- **Mint** – Secure a handful of dried mint leaves in one or more sachets, or dip several cotton balls in [peppermint essential oil](#) and place them with your stored items in airtight containers

What About White Camphor Oil?

As mentioned earlier, white camphor oil was, at one time, a primary ingredient in mothballs. Unlike naphthalene and paradichlorobenzene, white camphor has medicinal applications and is not regarded as a carcinogen. It is, however, toxic in large doses.

White camphor oil (*Cinnamomum camphora*) comes from the camphor tree, which is native to China, Japan and Taiwan (Formosa). It is sometimes grown in India and Sri Lanka as well. Camphor oil produces three distinct fractions – brown, yellow and white. Only white camphor oil is used for aromatic and medicinal purposes. The brown and yellow fractions contain a substance called safrole, a known carcinogen.

White camphor is a common ingredient in mentholated products and ointments designed to ease skin diseases and fungal infections. It can often be found in cold rubs and decongestant balms. Its intense penetrating scent makes white camphor oil an effective insect repellent, especially for deterring flies and moths. Due to its cooling and penetrating properties, white camphor oil offers several health benefits, including:¹⁸

- **Anesthetic** – Causes numbness of your sensory nerves at the area of application
- **Anti-inflammatory and sedative** – Reduces [inflammation](#) and helps calm your nerves, giving you a peaceful, relaxed feeling
- **Antispasmodic** – Gives immediate relief from muscle cramps, spasms and stiffness, which, by the way, could be caused by a [magnesium deficiency](#)
- **Decongestant** – Provides respiratory relief by reducing blockage in your bronchi, lungs and nasal passages

Cautions Related to White Camphor Oil

Although white camphor oil has many health benefits, keep the following cautions in mind. If you have any concerns or doubts, seek the advice of a health professional before using it.

Always use white camphor oil with a mild carrier oil, such as coconut oil

Before using topically, conduct a skin patch test to see if you are allergic to it

Do not administer white camphor oil to children due to potential skin sensitization and toxicity

Applying it at night may disrupt your sleep

Do not apply white camphor, or any oil, to burns or open wounds

If you have asthma, epilepsy or are pregnant, do not use white camphor oil due to its potential adverse effects

Never take white camphor oil internally

Sources and References

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- ⁷ Boston.com December 14, 2009
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