



No. 10: Using Insect Repellents Safely

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BACKGROUND

Chemicals designed to be applied directly to human skin to control pests are collectively referred to as insect repellents. Repellents are widely used against mosquitoes, blackflies, ticks, and other annoying insects and related arthropods. Some pests targeted by insect repellents are not only bothersome, but may also spread human disease. In recent years, concerns about Lyme disease, transmitted by the deer tick, and West Nile Virus (WNV), a mosquito-borne disease, have resulted in a corresponding increase in the use of insect repellents.

Repellents work by forming a barrier on the skin. This interferes with the pest's ability to identify the protected skin as suitable to bite or to feed from. Some insect repellent products registered for use in the U.S. contain ingredients derived from plants (botanicals), while others contain synthetic, or man-made, active ingredients. In efficacy tests, the synthetic active ingredients have generally provided longer-lasting control of pests than the natural active ingredients.

ACTIVE INGREDIENTS

DEET

One of the most common active ingredients in insect repellents is the chemical *N,N-diethyl-m-toluamide*, known generically as DEET. This repellent has been widely used for more than fifty years. There have been a small number of anecdotal and published reports of adverse reactions to DEET, especially in young children after repeated applications of repellents. Reactions such as headache, mood changes (crying, irritability), confusion, nausea, and, in severe cases, muscle spasms, convulsions, or unconsciousness have been reported. While DEET has not been confirmed as the cause of these incidents, there is concern that a small segment of the population may be sensitive to DEET, especially when it is misused or overapplied.

The U.S. Environmental Protection Agency (EPA) has not recommended that consumers stop using DEET repellents, since the benefits of tick and mosquito repellency may far

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outweigh any risk from DEET exposure in areas where Lyme disease, West Nile Virus, or other arthropod-borne diseases are of concern. As with any pesticide, however, care should be taken to avoid unnecessary exposure through overuse or misuse.

Picaridin

Picaridin, introduced in the U.S. in 2005, has been used worldwide since 1998 and is one of the best-selling active ingredients in Europe and Australia. In studies using laboratory animals, picaridin has been found to have relatively low toxicity to mammals through either oral or dermal (skin) exposure. Picaridin appears to have less of an irritant effect than DEET, and also has less of a detectable odor. It was registered as a "reduced-risk" chemical by the EPA. The product is available as a pump spray, aerosol, and towelettes.

Botanicals

"Natural" insect repellents marketed in the U.S. contain oils from a variety of plants including eucalyptus, cedar, peppermint, lemongrass, geranium, coconut, soybean, citronella, and others. In one independent study of insect repellent efficacy, a soybean oil product provided about 1½ hours of protection against mosquitoes. The six other botanicals tested provided an average of less than 20 minutes of protection.

Although these products are generally recognized as less acutely toxic than DEET or picaridin, there have been reports of adverse reactions such as skin irritation following use of botanical repellents, particularly when overused.

PRODUCTS FOR TREATMENT OF CLOTHES

Permethrin

Pyrethrum is a naturally occurring insecticide derived from chrysanthemums. *Permethrin* is a synthetic, more potent chemical related to pyrethrum that can be applied to clothing, camping gear, bed nets, etc. to repel insects. It is the only product in the U.S. registered for this use. Permethrin binds to fabric and can last up to two weeks, even after washing twice, and minimally transfers to skin. You can treat fabric with permethrin yourself or buy clothing or gear that has been pre-treated by the manufacturer.

Permethrin is only intended for fabric and should not be applied directly to skin; skin can quickly and significantly reduce the repellent's effectiveness. Also, in rare cases, skin irritation has developed. Fabrics should be treated according to label directions in a well-ventilated area and stored separately from non-treated clothing and other items. Clothing should be treated and allowed to dry at least 2-4 hours before wearing and only worn when needed for insect repellency.

EFFICACY

Required testing

Before any pesticide, including repellents, can be registered and used in the U.S., EPA requires certain data to be submitted and considered by the Agency. These tests include acute and chronic toxicity profiles, degradation (chemical breakdown) profiles, effects on certain indicator species,

environmental fate and effects, and many other test results. Each pesticide product is then labeled for use with very specific directions including the site on which it can be applied, how much and when to apply, etc.

Target pests

The label also lists the target pests the product is meant to control. For most pesticides, the company that manufactures or distributes the product is not required to submit efficacy data for each target pest. However, for products that claim to control a public health pest, such as mosquitoes and ticks that can transmit human diseases, efficacy data is required before the product label can make such a claim.

Duration of protection

The length of time an active ingredient provides protection against pests depends on the specific pest, concentration of the ingredient, heat and humidity, exercise, swimming or other water activities, and other factors. In laboratory and field tests, the duration of protection against various pests can range from 20 minutes to several hours, depending on the product.

Being aware of how long a product will provide protection against a particular pest helps consumers choose an appropriate product for their needs and helps ensure products are not over-applied (which increases unnecessary exposure to the chemical) or under-applied (which might increase the likelihood of transmission of arthropod-borne diseases).

At the time of this publication, EPA is considering implementing a voluntary program to help consumers understand how long a particular product is likely to remain effective. Under this program, manufacturers could add a pictogram to the repellent label identifying the pests it repels and the length

of time the product remains effective against each pest.

INSECT REPELLENTS AND CHILDREN

Use of repellents on children is common and sometimes necessary to achieve good control of nuisance and disease-carrying arthropods. In general, children are physiologically and developmentally at increased risk for toxic effects from any chemical, whether synthetic or natural. Therefore, it is important that repellents and other products applied directly to children be used with special care.

Scientists at the University of Maryland Pesticide Education and Assessment Program studied how repellents are actually applied to children by their parents or caregivers. While the study found a high rate of compliance with some recommended practices for application, other practices reported were of some concern. As recommended, most parents chose a low concentration of DEET (picaridin was not yet available in the U.S. when the study was conducted), avoided applying products directly to children's faces, and limited the number of times per day the child was treated without washing or otherwise removing the product between applications. However, almost a third of parents reported not reading or following label directions, some sprayed products directly onto their children's faces, and over half of the children did not wash the repellent off before going to bed.

PRECAUTIONS FOR SAFE USE OF REPELLENTS

To ensure any risks are minimized, parents and caregivers should read and follow all directions on insect repellent product labels. General recommendations are listed below.

Read the label before buying the product and again before using any pesticide.

Choose a repellent that specifically mentions the type of pest you want to repel. As explained above, efficacy data is required before products can claim to control or repel pests that can transmit human diseases. Therefore, a product whose label does not list pests such as mosquitoes or ticks is probably not effective against them. However, efficacy data are not required for annoying pests that are not documented to transmit human diseases. These pests may or may not be listed on the label.

Follow all use directions and precautions.

Use only the amount specified on the label, and only as often as the label directs.

Do not apply insect repellents to sensitive, absorptive areas of the body. Never apply repellents over eyes, the mouth, scratches, cuts, or irritated skin. Do not spray repellents directly on the face. Instead, apply to your hand and wipe onto the face, avoiding areas around the eyes and mouth.

Do not apply insect repellents to infants. In particular, do not apply DEET to children under the age of 6 months.

Do not allow young children to apply insect repellent themselves.

Do not apply repellents to the hands of children. Tell older children to avoid wiping their treated hands across their eyes and mouths.

If using DEET on children, choose a product that contains 10% or less DEET. U.S. and Canadian health authorities agree that these lower concentration products are safer for children.

Apply insect repellents only to exposed skin and/or clothing as the label directs. Application beneath clothing is not

necessary, and clothing may increase absorption of the pesticide through your skin by increasing warmth and humidity.

Use only the amount needed to cover once. Saturation of skin or clothing should be avoided.

Apply repellents only as frequently as the label directs. If the label has no specific directions on frequency of application, apply a repellent to skin only once a day, or wash it off between applications. If you are treating clothing with permethrin, apply it to fabric only once every two weeks, and wash the fabric between applications.

Combination repellent/sunscreen products are not recommended. Frequent application of sunscreen is usually desirable to prevent ultraviolet light exposure, whereas repellents should be applied as infrequently as possible. This makes it unlikely that a combination product would be the best option. Choose separate repellents and sunscreen, and use each according to its own directions.

After returning indoors, wash treated skin with soap and water. This is particularly important when repellents are used on consecutive days. Going to bed with insect repellent still on your skin can transfer residues to the bed linens, resulting in potential continued exposure to the repellent.

Always keep pesticide containers out of reach of children. Store them where children cannot reach them.

Use similar precautions when treating pets. Check the label to make sure the product is recommended for your pet. Follow all label directions, being sure not to apply more than the recommended amount. Do not treat newborns.

If you suspect a reaction to an insect repellent, wash treated skin with soap and water, then call your physician or local Poison Control Center. The nation-wide Poison Center toll-free telephone number is **1-800-222-1222**; the operator will direct your call to your local Poison Center. Telephone

numbers for these Centers are also listed on the inside front cover of your telephone book. Have the repellent label with you so the doctor or other medical professional can determine the active ingredient and concentration, which is necessary for proper treatment of an over-exposure.

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