DEET

N-diethyl-3-methylbenzamide

Fact Sheet

General

DEET is an insect repellent that is used on human skin and clothing, on animals, and around residences and animal quarters. A broad spectrum repellent, it can be used to control mosquitoes, biting midges, chiggers, fleas, gnats, no-see-ums, ticks, and a variety of flies (NCAMP 2002). While is it highly effective, scientific studies have raised concerns about its toxicity to humans and animals when used alone or in conjunction with other chemicals.

How it works

DEET's precise mode of action is currently unconfirmed. However, it is suspected that it works by impeding insects' ability to locate their prey. DEET likely interferes with sensory receptors on insects' antennae, preventing them from detecting chemicals emitted by humans and other animals. (Davis and Sokolove 1976)

Toxicity

DEET is classified as "slightly toxic," which is why it can be applied directly to skin (US EPA 1998). Between 9% and 56% of DEET is absorbed through the skin, mostly within 2 hours following application (Robins and Cherniak 1986). The majority of absorbed DEET is then excreted in the urine within 12 hours (Fradin 1998). For adult rats, its LD_{50} (the amount of a chemical required to kill 50% of a test population) is 2 g/kg body weight – a low value compared to most other pesticides (NCAMP 2002). However, low as well as high doses of DEET have resulted in human and animal health problems.

Application of DEET to human and animal skin can cause important skin and eye problems. Animal reactions include erythema, desquamation, scarring, profuse sweating, irritation and exfoliation, edema, tearing, conjunctivitis, pus, and clouding in the eyes (NYDOH 1991). Human conditions from high DEET exposure to include a variety of rashes, contact dermatitis, conjunctivitis, aggravation of existing acne, irritation of skin and mucous membranes, and numb or burning sensation of lips (NCAMP 2002).

Neurological problems have also been linked to DEET exposure. Research in rats revealed that high levels of DEET can kill neurons (brain cells) in areas of the brain that control muscle movement, learning, memory, and concentration (Abu-Donia *et al.* 2001). This corresponds to documented symptoms exhibited by humans who were exposed to high levels of DEET, such as Persian Gulf War veterans. Many of these individuals experienced memory loss, headache, weakness, fatigue, muscle and joint pain, tremors, and shortness of breath (NCAMP 2002).

While most DEET-linked health problems in adults are reported with high levels of exposure, problems among children are a reminder that even low levels can pose a threat. For example, multiple cases of toxic encephalopathy (degeneration of the brain) were reported among young children following repeated exposure to DEET. One child even died from this condition after repeated application of a repellent containing merely 10% DEET (NYDOH 1991). Considering such cases, it is alarming that comprehensive studies of the chronic effects on humans have never been done considering children specifically. Since it is known children are more susceptible to health risks associated with pesticide use due to their size, weight, immunology and behaviour, such a knowledge gap is unacceptable.

Synergistic Effects

Not only is DEET use a concern in itself, but its health risks may increase when it is used in combination with other chemicals. For example, DEET is often used with Permethrin, a powerful insecticide that kills insects upon contact, but is of low toxicity to humans. DEET on skin combined with Permethrin on clothing is extremely effective at preventing mosquito bites (Fradin 1998). However, this combination has been shown to cause brain and behavioural deficits in rats. A study done by Abou-Donia *et al.* (2001a) reported that rats appeared normal but demonstrated serious deficits in muscle control, strength and

coordination. Later investigation revealed a large number of cell deaths in areas of the brain that control muscle movement, memory learning, concentration, and synchronizing body movements. In effect, these two chemicals that seemed harmless on their own were highly toxic to the nervous system when used together. Dr. Abou-Donia also warns of the possibility of heightened toxicity when DEET is used in combination with medications, especially antihistamines, or when the user is exposed to other common chemicals, such as residential garden pesticides (NCAMP 2002).

Canadian regulations

Despite the fact that DEET has been federally registered since 1985, simple scientific tests to determine their threshold for effectiveness were either not done or ignored. Citing health risks and evidence that higher concentrations are not more effective, in April of 2002 Health Canada banned insect repellents with more than 30% active DEET. As of December 2004, retailers must discontinue sale of these products.

Using DEET carefully

DEET should not be used by pregnant women or on infants (under 2 years old), and one should always take safety precautions when using it on children in general. Do not apply DEET indoors. Individuals taking medication such as antihistamines should not use DEET. If you are taking other types of medication, verify that DEET will not cause adverse synergistic effects with the medication in question. Apply DEET-based repellents sparingly to exposed skin and never under clothing. To reduce the risk of toxic effects, do not apply DEET to broken, irritated, or sunburned skin. Finally, be sure to wash DEET-exposed skin with soap and water as soon as possible upon returning indoors.

Safer alternatives

Consider these tips for non-toxic insect control:

- Use herbs to help repel mosquitoes. Effective herbs include cedarwood, garlic, lemongrass, frankincense, cinnamon, geranium, eucalyptus, basil, rosemary, cloves, peppermint, lemon balm, onions, feverfew, thyme and marigold.
- Mix your own essential oil repellent. Add 7-10 drops of essential oil to 2 tbsp. of vegetable oil. Be aware, however, that these essential oils are quite strong and can bother individuals with chemical sensitivities. Some can even induce labour, so **pregnant women should consult their doctor before using any essential oil.**
- Replace outdoor incandescent lights with yellow 'bug lights' which attract fewer mosquitoes.
- Wear a long sleeved shirt and long pants when outdoors, especially from dusk until dawn. Loose clothing made of thicker materials is the most difficult for mosquitoes to bite through.
- If possible, spend more time on screened in porches than open porches.

Works cited

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