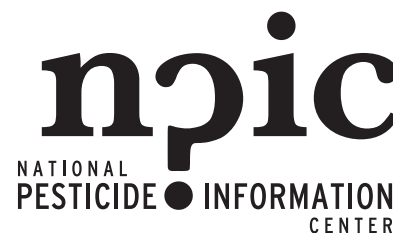


ACEPHATE

fact sheet



What is acephate?

Acephate is an organophosphate insecticide. It is used on food crops, citrus trees, as a seed treatment, on golf courses, and in commercial or institutional facilities. At one time acephate was used commonly in and around homes, but most of those uses are no longer allowed. Acephate has been registered by the U.S. EPA since 1973.



photo credit: RobbyFo, pixabay

What are some products that contain acephate?

Acephate products may be sold as powders, liquids, granules, tablets, and in water-soluble packets. About 100 products that contain acephate are currently registered.

IMPORTANT: Always follow label instructions and take steps to avoid exposure. If any exposures occur, be sure to follow the First Aid instructions on the product label carefully. For additional treatment advice, contact the Poison Control Center at 800-222-1222. If you wish to discuss a pesticide problem, please call 1-800-858-7378.

How does acephate work?

Acephate can kill target insects when they touch it or eat it. When insects eat acephate, their bodies turn it into a chemical called methamidophos, which is another, stronger insecticide. Acephate is less toxic in mammals because mammal bodies do not turn it into methamidophos very well.

Acephate and methamidophos affect the nervous system, causing over-activity in the nerves, muscles, or brain. Acephate is absorbed into plants, so insects that feed on treated plants may eat acephate.

How might I be exposed to acephate?

People can be exposed while applying acephate by breathing in the spray mist or by getting spray or granules on their skin. Lower levels of exposure can happen if people work with acephate-treated soils or plants. People may eat acephate residues on fruits or vegetables that were treated with acephate.

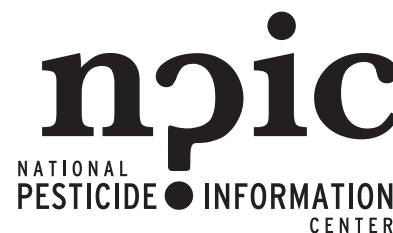
What are some signs and symptoms from a brief exposure to acephate?

People exposed to acephate have had nausea, diarrhea, abdominal cramps, shaking, sweating, rapid heart rate, dizziness, and/or confusion. Symptoms usually begin within minutes or hours after exposure.

Pets might be exposed to acephate by eating granules from the ground. Dogs that ate acephate had vomiting, diarrhea, shaking, and difficulty walking and breathing. Signs of toxicity in birds include clumsiness, depression, shortness of breath, feather puffing, drooped wings, shaking, and convulsions.

ACEPHATE

fact sheet



What happens to acephate when it enters the body?

Humans and animals absorb acephate into the body quickly when it is eaten, breathed in, or gets on the skin. In animal studies, acephate was absorbed into the blood and went to skin, liver, kidneys, and heart.

In humans and other mammals, about three quarters of the acephate moves through the body unchanged. Some is broken down into smaller chemicals, and a very small amount converts to methamidophos. In rats, most acephate was cleared through the urine, with small amounts cleared through the feces or exhaled breath. Acephate clears the body quickly; less than one percent of the acephate remained in rats three days after eating it.

Is acephate likely to contribute to the development of cancer?

The EPA classifies acephate as a “possible human carcinogen.” When animals were fed acephate in their diets for two years, a greater number of them had liver or adrenal gland tumors. Mice that were fed high doses of acephate all at once had DNA damage in blood cells, although the damage was repaired four days after the exposure.

Has anyone studied non-cancer effects from long-term exposure to acephate?

When rats were fed acephate every day for generations, the animals had reduced mating success and lower survival of their offspring. No changes in nervous system development, behavior or cognitive abilities were seen in offspring in pre- and post-natal exposure studies. Acephate exposure has not been known to cause organophosphate-associated conditions such as intermediate syndrome or Organophosphate-Induced Delayed Polyneuropathy.

Are children more sensitive to acephate than adults?

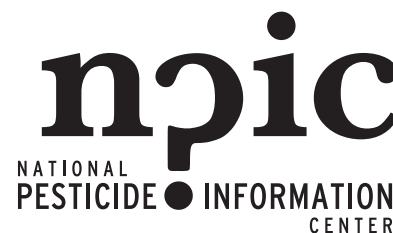
In general, children may be especially sensitive to pesticides compared to adults. However, there are currently no studies indicating that children are more sensitive to acephate, specifically. Children may have different symptoms than adults, such as drooling, seizures, muscle weakness, lethargy, coma, and pupil constriction.

What happens to acephate in the environment?

Small amounts of acephate can change into methamidophos in soil, plants, and insects. Both chemicals are very mobile in soil, moving with water easily. However, they break down relatively quickly. The half-life of acephate ranged from 4.5 to 32 days in soil. Acephate does not tend to off-gas from soil or water. Plants absorb acephate quickly from the soil into their roots or through their leaves, and move it to other parts of the plant.

ACEPHATE

fact sheet



Can acephate affect birds, fish, or other wildlife?

Acephate is moderately toxic to birds, depending on the species. Acephate-related health effects in wild birds are reduced eggs, egg hatching, and hatchling survival, and possibly disrupted migratory patterns.

Acephate is slightly toxic to fish and amphibians. After high exposures, salamander hatchlings had decreased growth, activity, and feeding, and increased muscle and spinal column deformities. Acephate is a broad-spectrum insecticide and is highly toxic to bees and other beneficial insects.

Where can I get more information?

For more detailed information, please visit the list of referenced resources below, call NPIC at 800-858-7378, or email us at npic@oregonstate.edu. NPIC provides objective, science-based answers to questions about pesticides.

Date Reviewed: June 2011

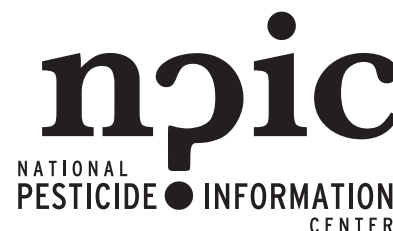
Cite as: Christiansen, A.; Gervais, J.; Buhl, K.; Stone, D. 2011. *Acephate General Fact Sheet*; National Pesticide Information Center, Oregon State University Extension Services. npic.orst.edu/factsheets/acephagen.html.

References:

1. *Reregistration Eligibility Decision (RED) Acephate*; EPA 738-R-01-013; U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC, 2006; pp 1-87.
2. Roberts, T. R.; Hutson, D. H. Acephate. *Metabolic Pathways of Agrochemicals - Part 2: Insecticides and Fungicides*; The Royal Society of Chemistry: Cambridge, UK, 1999; pp 201-204.
3. *Pesticide Fact Sheet Acephate*; U. S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC, 1987; pp 1-10.
4. Downing, E. *Environmental Fate of Acephate*; California Department of Pesticide Regulation, Environmental Monitoring and Pest Management: Sacramento, CA, 2000; p 11.
5. Yen, J-H.; Lin, K-H.; Wang, Y-S. Potential of the Insecticides Acephate and Methamidophos to Contaminate Groundwater. *Ecotoxicol. Environ. Saf.* 2000, 45, 79-86.
6. Davy, M.; Eckel, W. P.; Hammer, C. *Risks of Acephate Use to the Federally Listed California Red Legged Frog (Rana aurora draytonii)*; U.S. Environmental Protection Agency, Office of Pesticide Programs, Environmental Fate and Effects Division: Washington, DC, 2007; p 122.
7. Tomlin, C. D. S. *The Pesticide Manual, A World Compendium, 14th ed.*; British Crop Protection Council: Alton, Hampshire, UK, 2006; pp 5-6.
8. Thomson, W. T. Acephate. *Agricultural Chemicals Book I - Insecticides, Acaricides, and Ovicides*; Thomson Publications: Fresno, CA, 1989; p 1.
9. Klaassen, C. D. *Casarett and Doull's Toxicology The Basic Science of Poisons, 6th ed.*; McGraw-Hill: New York, 2001; p 1236.

ACEPHATE

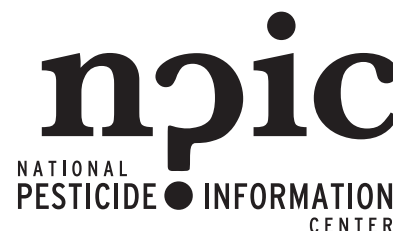
fact sheet



10. Reigart, J. R.; Roberts, J. R. Organophosphate Insecticides. *Recognition and Management of Pesticide Poisonings*, 5th ed.; U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs; U.S. Government Printing Office: Washington, DC, 1999; pp 34-47.
11. Chuckwudebe, A. C.; Hussain, M. A.; Oloffs, P. C. Hydrolytic and Metabolic Products of Acephate. *J. Environ. Sci. Health* 1984, B19 (6), 501-522.
12. Farag, A. T.; Eweidah, M. H.; El-Okazy, A. M. Reproductive toxicology of acephate in male mice. *Reprod. Toxicol.* 2000, 14, 457-462.
13. Mahajna, M.; Quistad, G. B.; Casida, J. E. Acephate Insecticide Toxicity: Safety Conferred by Inhibition of the Bioactivating Carboxamidase by the Metabolite Methamidophos. *Chem. Res. Toxicol.* 1997, 10, 64-69.
14. Chapman, R. F. *The Insects Structure and Function*, 4th ed.; Cambridge University Press: Cambridge, UK, 1998; p 542.
15. Smith, D. S.; Treherne, J. E. The Electron Microscopic Localizations of Cholinesterase Activity in the Central Nervous System of an Insect, *Periplaneta americana* L. *J. Cell Biol.* 1965, 26, 445-465.
16. Spassova, D.; White, T.; Singh, A. K. Acute effects of acephate and methamidophos on acetylcholinesterase activity, endocrine system and amino acid concentrations in rats. *Comp. Biochem. Physiol. Part C* 2000, 126, 79-89.
17. WHO. *Pesticide residues in food - 2002: Acephate*; International Programme on Chemical Safety, World Health Organization: Geneva, Switzerland, 2003; pp 3-35.
18. Vyas, N. B.; Kuenzel, W. J.; Hill, E. F.; Romo, G. A.; Komaragiri, M. V. S. Regional Cholinesterase Activity in White-Throated Sparrow Brain is Differentially Affected by Acephate (Orthene®). *Comp. Biochem. Physiol.* 1996, 113C (3), 381-386.
19. Wilson, B. W.; Henderson, J. D.; Kellner, T. P.; McEuen, S. F.; Griffis, L. C.; Lai, J. C. Acetylcholinesterase and Neuropathy Target Esterase in Chickens Treated with Acephate. *Neurotoxicol.* 1990, 11, 483-492.
20. WHO. *Pesticide residues in food - 2005: Acephate*; International Programme on Chemical Safety, World Health Organization: Geneva, Switzerland, 2005; pp 3-16.
21. Silveira, R. F.; Cushman, J. R.; Wong, Z. A. Modified Buehler test for the skin sensitization potential of Chevron acephate technical (SX-1102). Unpublished Report no. SOCAL 1840, 1984, submitted to WHO by Tomen Agro, Inc., San Francisco, CA, prepared by Chevron Environmental Health Center, Richmond, CA. EPA MRID 00119085. *Reregistration Eligibility Decision (RED) Acephate; EPA 738-R-01-013*; U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC, 2006.
22. Narcisse, J. K.; Cavalli, R. D.; Spence, J. A. Eye irritation potential of Orthene technical, Orthene 75S, (CC-2153) and Orthene 7S (CC-2152). Unpublished Report no. SOCAL 273, 1971, submitted to WHO by Tomen Agro, Inc., San Francisco, CA, prepared by Standard Oil Company of California. *Pesticide residues in food - 2002: Acephate*; International Programme on Chemical Safety, World Health Organization: Geneva, Switzerland, 2003.
23. Levy, J. E.; Wong, Z. A.; MacGregor, J. A. The eye irritation potential of Orthene specialty concentration. Unpublished Report no. SOCAL 1419, 1979, submitted to WHO by Tomen Agro, Inc., San Francisco, CA, prepared by Chevron Environmental Health Center, Richmond, CA. *Pesticide residues in food - 2002: Acephate*; International Programme on Chemical Safety, World Health Organization: Geneva, Switzerland, 2003.
24. Rittenhouse, J. R.; Wong, Z. A.; MacGregor, J. A. The acute inhalation toxicity of Orthene specialty concentration. Unpublished Report no. SOCAL 1420, 1979, submitted to WHO by Tomen Agro, Inc., San

ACEPHATE

fact sheet

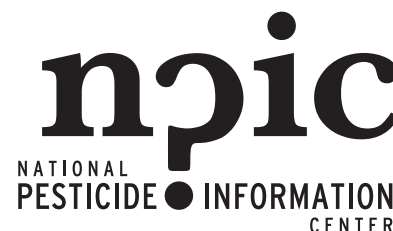


Francisco, CA, prepared by Chevron Environmental Health Center, Richmond, CA. EPA MRID 00015307. *Reregistration Eligibility Decision (RED) Acephate*; EPA 738-R-01-013; U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC, 2006.

25. WHO. *Pesticide residues in food - 1976: Acephate*; International Programme on Chemical Safety, World Health Organization: Geneva, Switzerland, 1976.
26. Zinkl, J. G.; Roberts, R. B.; Shea, P. J.; Lasmanis, J. Toxicity of Acephate and Methamidophos to Dark-eyed Juncos. *Arch. Environ. Contam. Toxicol.* 1981, 10, 185-192.
27. *Memorandum: Updated Review of Acephate Incident Reports*; U.S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, U.S. Government Printing Office: Washington, DC, 2009.
28. *Integrated Risk Information System Acephate*; U.S. Environmental Protection Agency. https://iris.epa.gov/ChemicalLanding/&substance_nmbr=354 (accessed Dec 2007), updated Oct 1993.
29. Singh, A. K.; Drewes, L. R. Neurotoxic Effects of Low-Level Chronic Acephate Exposure in Rats. *Environ. Res.* 1987, 43, 342- 349.
30. Krieger, R. Cholinesterases. *Handbook of Pesticide Toxicology*; Academic Press: San Diego, CA, 2001; Vol. 2, p 967-1075.
31. Joshi, A. K. R. J.; Rajini, P. S. Reversible hyperglycemia in rats following acute exposure to acephate, an organophosphorus insecticide: Role of gluconeogenesis. *Toxicology* 2009, 257, 40-45.
32. Kumar, S. Changes in rat brain regions serotonergic system following acephate poisoning. *Pestic. Biochem. Physiol.* 2004, 78, 140-150.
33. Singh, A. K. Acute effects of acephate and methamidophos and interleukin-1 on corticotropin -releasing factor (CRF) synthesis in and release from the hypothalamus in vitro. *Comp. Biochem. Physiol. Part C*, 2002, 132, 9-24.
34. Draft List of Initial Pesticide Active Ingredients and Pesticide Inerts to be Considered for Screening under the Federal Food, Drug, and Cosmetic Act. *Fed. Reg.* 2007, 72 (116), 33486-33503.
35. Rahman, M. F.; Mahboob, M.; Danadevi, K.; Banu, B. S.; Grover, P. Assessment of genotoxic effects of chlorpyrifos and acephate by the comet assay in mice leucocytes. *Mutat. Res.* 2002, 516, 139-147.
36. Behera, B. C.; Bhunya, S. P. Studies on the genotoxicity of asataf (acephate), an organophosphate insecticide, in a mammalian in vivo system. *Mutat. Res.* 1989, 223, 287-293.
37. *Human Health Risk Assessment Acephate*; U.S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Office of Pesticide Programs, Health Effects Division, U.S. Government Printing Office: Washing, DC, 2000; p 20.
38. *Hazardous Substances Data Bank (HSDB), Acephate*. <https://pubchem.ncbi.nlm.nih.gov/source/hsdb/6549> (accessed Dec 2007), updated June 2005.
39. Tucker, B. V. S-methyl-14c-Orthene dermal treatment of rats. Unpublished Report no. 721-11,1974, submitted to WHO by Tomen Agro, Inc., San Francisco, CA, prepared by Chevron Environmental Health Center, Richmond, CA. *Pesticide residues in food - 2002: Acephate*; International Programme on Chemical Safety, World Health Organization: Geneva, Switzerland, 2003.
40. Maroni, M.; Catenacci, G.; Galli, D.; Cavallo, D.; Ravazzani, 40. G. Biological Monitoring of Human Exposure to Acephate. *Arch. Environ. Contam. Toxicol.* 1990, 19, 782-788.
41. Tanaka, T.; Tanaka, N.; Kita, T.; Kasai, K.; Sato, H. Acephate in Biological Fluids of Two Autopsy Cases after Ingestion of the Chemical. *J. Forensic Sci.* 2005, 50 (4), 1-4.

ACEPHATE

fact sheet



42. Lee, H. Metabolism of orthene in rats. Unpublished report, 1972, submitted to WHO by Ortho Division of the Chevron Chemical Company. *Pesticide residues in food - 1976: Acephate*; International Programme on Chemical Safety, World Health Organization: Geneva, Switzerland, 1976.
43. Nigg, H. N.; Knaak, J. B. Blood Cholinesterase as Human Biomarkers of Organophosphorus Pesticide Exposure. *Rev. Environ. Contam. Toxicol.* 2000, 163, 29-112.
44. Harrington, M. J. *Pesticide Exposure Monitoring, Background and Perspectives on Mandatory Cholinesterase Testing*. Agrichemical and Environmental News; Washington State University Cooperative Extension: Pullman, WA, 2002; Vol. 194, pp 1-6.
45. CDC. *Organophosphate Insecticides: Dialkyl Phosphate Metabolites*; U.S. Department of Health and Human Services, Centers for Disease Control and Prevention: Atlanta, GA, 2010.
46. Vogue, P. A.; Kerle, E. A.; Jenkins, J. J. *OSU Extension Pesticide Properties Database*; Oregon State University: Corvallis, OR, 1994.
47. Geen, G. H.; Hussain, M. A.; Oloffs, P. C.; McKeown, B. A. Fate and toxicity of acephate (Orthene®) added to a coastal B. C. Stream. *J. Environ. Sci. Health* 1981, B16 (3), 253-271.
48. Szeto, S. Y.; MacCarthy, H. R.; Oloffs, P. C.; Shepherd, R. F. The fate of acephate and carbaryl in water. *J. Environ. Sci. Health* 1979, B14 (6), 635-654.
49. Fiedler, L. Acephate Residues After Pre-Blossom Treatments: Effects on Small Colonies of Honey Bees. *Bull. Environ. Contam. Toxicol.* 1987, 38, 594-601.
50. *Pesticide Data Program Annual Summary, Calendar Year 2008*; U.S. Department of Agriculture, Agricultural Marketing Service: Washington, DC, 2009.
51. *Pesticide Data Program Annual Summary, Calendar Year 2006*; U.S. Department of Agriculture, Agricultural Marketing Service: Washington, DC, 2007.
52. Booth, G. M.; Woodfield, J.; Simmons, D. The effects of Orthene® and Monitor® on small mammal and bird brain cholinesterase activity. Activity Number FS-PNW-Grant No. 49, 1977, submitted to U.S. Forest Service by Douglas-fir Tussock Moth Program. Zinkl, J. G.; Roberts, R. B.; Shea, P. J.; Lasmanis, J. Toxicity of Acephate and Methamidophos to Dark-eyed Juncos. *Arch. Environ. Contam. Toxicol.* 1981, 10, 185-192.
53. Zinkl, J. G.; Roberts, R. B.; Henry, C. J.; Lenhart, D. J. Inhibition of Brain Cholinesterase Activity in Forest Birds and Squirrels Exposed to Aerially Applied Acephate. *Bull. Environ. Contam. Toxicol.* 1980, 24, 676-683.
54. Fleming, W. J.; Bradbury, S. P. Recovery of cholinesterase activity in mallard ducklings administered organophosphorus pesticides. *J. Toxicol. Environ. Health* 1981, 8, 885-897.
55. Vyas, N. B.; Kuenzel, W. J.; Elwood, F. H.; Sauer, J. R. Acephate affects migratory orientation of the white-throated sparrow (*Zonotrichia albicollis*). *Environ. Toxicol. Chem.* 1995, 14 (11), 1961-1965.
56. Geen, G. H.; McKeown, B. A.; Watson, T. A.; Parker, D. B. Effects of Acephate (Orthene®) on Development and Survival of the Salamander, *Ambystoma gracile* (Baird). *J. Environ. Sci. Health* 1984, B19 (2), 157-170.

NPIC is a cooperative agreement between Oregon State University and the U.S. Environmental Protection Agency (U.S. EPA). The information in this publication does not in any way replace or supercede the restrictions, precautions, directions, or other information on the pesticide label or any other regulatory requirements, nor does it necessarily reflect the position of the U.S. EPA.



Oregon State
University