BIOLOGICAL PESTICIDES CHEMICAL FACT SHEET

Formulations

Two bacteria are commonly used as biological controls for insects: *Bacillus thuringiensis* (Bt) and *Bacillus sphaericus* serotype H5a5b, strain 2362 (Bsp). A subspecies of Bt, *Bacillus thuringiensis israelensis* (Bti), is approved for aquatic use. Bti was registered with the U.S. EPA in 1983 for control of black flies, mosquitoes and midges. Bsp was registered with the U.S. EPA in 1991 for control of mosquitos. Both Bti and Bsp are currently under registration review. An interim registration review decision for Bsp was released in 2020, and an interim registration review decision for Bti is expected in 2024. Bti and Bsp are available in powdered, liquid and pellet formulations, and can be applied aerially or by ground. Commercial formulations of Bti approved for aquatic use in Wisconsin include Aquabac®, VectoBac®, Mosquito Dunks® and Teknar®*. Commercial formulations of Bsp approved for aquatic use in Wisconsin include Spheratax® SPH (50G) and VectoLex®.*

Aquatic Use and Considerations

Bti and Bsp are both spore-forming bacteria. The spores contain a protein crystal that, once eaten by an insect larva, converts into toxins that damage the stomach. The larva then stops eating and dies from either starvation or infection. Bti and Bsp spores will not affect adult insects.

Bti and Bsp have different strains that are species-specific (i.e., they only affect certain insect species). The protein crystal varies slightly between strains and will only affect insects that have the right level of alkalinity in their gut to dissolve the crystal into toxins and have the receptors for the toxin.

Bti and Bsp are designed for use in habitats where target insects lay eggs. Control of insect larvae after application ranges from a couple days to over a month depending on environmental conditions and application rate. Efficacy may be lowered in waterbodies with matted algae, high organic matter or flowing water. Utilize effective integrated pest management strategies as part of any long-term control program.

Bti and Bsp target insect species in the orders lepidoptera (butterflies & moths), coleoptera (beetles & weevils) and diptera (true flies). Bti is labeled to control mosquitoes, black flies and some midges (gnats). Bsp is labeled to control mosquitos.†

Post-Treatment Water Use Restrictions

There are no post-treatment restrictions on treated water use for swimming, fishing, pet/livestock drinking water or irrigation. Bti and Bsp products are not intended for use in drinking water reservoirs.†

Degradation, Persistence and Trace Contaminants

Bti and Bsp are broken down in water by sunlight and microbes. Both the bacteria and their produced toxins degrade rapidly in sunlight. They have a half-life (the time it takes for half of the active ingredient to degrade) ranging from about four hours to four days when exposed to sunlight. Persistence of Bti and Bsp is also highly dependent on water temperature and pH. The bacteria are less

* Product names are provided solely for your reference and should not be considered exhaustive nor endorsements.

† May vary by formulation, application rate, and/or product. Every product label must be carefully read and followed by the user.

active (i.e., produce fewer spores) in colder temperatures or in high/low pH conditions (pH below 5.0 or above 10.0). Bsp is less sensitive to environmental stressors than Bti and often persists longer under field conditions.

After application, Bti and Bsp settle from the water column to the lake bottom within about a week. Spores and their toxins are absorbed by organic matter floating in the water column and in the sediment. The bacteria may release toxins again if the sediment is disturbed sufficiently to re-suspend spores. Bacteria and spores can persist in the sediment for up to nine months. Leaching through sediment into groundwater is not expected with Bti or Bsp due to immobility in soil.

Impacts on Fish and Other Aquatic Organisms

Currently available Bti and Bsp products are nontoxic to fish, aquatic invertebrates and aquatic plants at label application rates. Previous solutions of Bti demonstrated short-term toxicity to fathead minnows due to an inert additive, which has since been discontinued. Bti was also moderately toxic to *Daphnia* spp. due to a separate toxin released by the bacteria unrelated to the toxin that causes target insect death. However, the U.S. EPA has since mandated Bti manufacturers to demonstrate that their product is unable to produce the undesired toxin.

Bti and Bsp are nontoxic to birds and mammals at label application rates. Birds and mammals that feed on insect larvae may be indirectly impacted by the removal of a food source.

Human Health

Chemical applicators are primarily at risk of adverse health effects. Bti and Bsp products can be harmful if inhaled or adsorbed through the skin. They can also cause moderate eye irritation. Wear personal protective equipment and follow label instructions while handling.

For Additional Information

U.S. Environmental Protection Agency (EPA)
Office of Pesticide Programs
epa.gov/pesticides

Wisconsin Department of Agriculture, Trade, and Consumer Protection
datcp.wi.gov/Pages/Programs_Services/ACMOverview.aspx

Wisconsin Department of Natural Resources
608-266-2621
dnr.wi.gov/lakes/plants

Wisconsin Department of Health Services
dhs.wisconsin.gov

National Pesticide Information Center
1-800-858-7378
npic.orst.edu