



Algae: An environmental menace

Algae is a significant and growing cause of environmental degradation called eutrophication and is cited as one of the most widespread environmental problems of inland waters by the United Nations Environment Program. (http://www.unep.or.jp/ietc/publications/short_series/lakereservoirs-3/1.asp) It's also an operational nuisance leading to broken down water systems and the production of toxins and noxious gases harmful to humans and animals alike. OCION's suite of bacteriostatic algaecide products are uniquely designed to offer an environmentally responsible solution to this worldwide ecological concern.

Primary Cause

Environment Canada has identified the massive increases in the use of fertilizer, burning of fossil fuels, urban populations, land clearing and deforestation and associated nutrient runoffs as primary causes of the significant trend in aquatic eutrophication. Phosphorous storage in freshwater and terrestrial ecosystems alone has been estimated to have increased by as much as 75% since pre-industrial times.

http://nrs-staff.mcgill.ca/bennett/pdfs/01_GLOBALP.PDF

And nitrate levels in groundwater are exceeding drinking water guidelines with greater volume and frequency across Canada.

Troubling Effects

Decreased biodiversity, changes in species composition and dominance, and toxicity are three troubling ecological effects of eutrophication. At low levels, it creates significant aesthetic issues: increased turbidity (decrease in water transparency), odor and color. The build-up of organic matter poses additional problems in filtration for water systems. As levels of cyanobacteria and cyanotoxins caused by algae blooms increase so do health and environmental concerns. The World Health Organization (WHO) Guidelines for Drinking Water Quality says that 100,000 cells or toxins/mL is a moderate human health risk.

http://www.who.int/water_sanitation_health/publications/2011/dwq_guidelines/en/index.html

While essential for all living things, high levels of nitrate-nitrogen in drinking waters can pose serious health risks, especially for infants and pregnant women.

<http://www.ec.gc.ca/inre-nwri/default.asp?lang=En&n=235D11EB-1&offset=7&toc=show>



A Deadly Cycle

When an aquatic ecosystem experiences an increase in nutrients, whether through natural processes or human activity, bio-diversity is pushed out of balance and bio-matter such as algae thrive to the detriment of other plants and aquatic life. Cyanobacteria or blue green algae presents as a mass of typically greenish slime or scum and often has a foul odor as the algae dies and decomposes. Algal blooms limit the sunlight available to bottom-dwelling organisms and cause wide swings in the amount of dissolved oxygen in the water. Without light, plants cannot photosynthesize. Under these so-called eutrophic conditions, dissolved oxygen greatly increases during the day, but is greatly reduced after dark by the respiring algae and by microorganisms feeding on the growing mass of dead algae. It becomes a self-perpetuating and injurious cycle. Vegetation becomes more dense along banks and shores and dead plants, insects and animals accumulate in an ever-thickening benthic layers. Fish and other marine animals suffocate when oxygen depletion reaches hypoxic levels. Anaerobic conditions can follow and a Dead Zone - where bacteria flourish producing cyanotoxins deadly to birds and mammals - is born.

Soil is also subject to degradation from eutrophication. Nitrogen runoff from commercial fertilizer and farmyard manure is highly mobile in the soil and can also affect groundwater. Additionally, nitrogen supply through the air and precipitation also affect vegetation. Nitrophilous species such as cow parsley, stinging nettles and rose bay flourish to the detriment of more desirable species. Lichen and mosses too give way to unicellular green algae on tree trunks and other surfaces.

Microcystins and Drinking Water

The toxins produced during algae blooms are possible carcinogens to humans, and current research is studying the link between certain cyanobacterial toxins and neurological diseases such as Lou Gehrig's disease.

Microcystins are the most common form of cyanotoxin resulting from algae blooms with 60 different types having varying levels of toxicity. Microcystins may act as tumor promoters and there is increasing evidence that these compounds may be more harmful through long term chronic exposure, such as low doses in drinking water, rather than short term acute exposure. This chronic toxicity is of significant concern to communities that are consuming drinking water with cyanotoxins in small doses over a lifetime.

Other toxins found in harmful algal blooms include nodularin, anatoxin, lyngbya, and cylindrospermopsis. Saxitoxins, the cause of paralytic shellfish poisons, are highly poisonous. Lyngbya toxin and aplysiatoxins are both carcinogenic. Cylindrospermopsis is most harmful to the liver, but other organs may also be damaged by it.



Algae and Recreational Water

Algae blooms threaten our recreational enjoyment of water. Canada's Lake Winnipeg, with an annual tourism industry valued at \$100 Million, has what is considered the worst algae problem of any large freshwater lake in the world seriously threatening this important economic resource. Aesthetically, the water becomes murky and uninviting. But the health risks are real. While there has only been one human death in the US possibly related to recreational exposure to microcystins, gastrointestinal distress, skin irritation and nausea are all common reactions. There is also growing evidence that microcystins can be aerosolized, thereby increasing the risk of exposure during recreational activities such as boating and jet-skiing. [http://www.who.int/water_sanitation_health/resourcesquality/toxicyanbact/en/](http://www.who.int/water_sanitation_health/resourcesquality/toxiccyanbact/en/)

Algae threatens Fisheries

Algae blooms also threaten the recreational and commercial fishing industries. Desirable edible fish stocks give way to larger coarser fish. http://pubs.ext.vt.edu/424/424-029/424-029_pdf.pdf The harvest of shellfish and mollusks is greatly reduced and the fishery frequently shut down as they become contaminated and/or threatened during "Red Tides". Saxitoxins, the cause of paralytic shellfish poisons, are highly poisonous.

Algae Types

Planktonic algae - Blue green algae are single cell or chain-like groups of cells which are free-floating and green, blue green or brown in colour. They commonly appear as small specks or take on the appearance of "grass clippings" in the water. Upon death they may release foul odours and tastes into the water. Some species of blue green algae form a pea green slime on the water surface, which can be extremely toxic to livestock. Algae can also cause severe swings in the dissolved oxygen levels in dugouts.

Filamentous algae - These types are commonly called "pond scum" or "moss" because they form a stringy hair-like mat on the water surface. This type of algae usually begins to grow near the bottom of a water body and float to the surface during hot, calm, sunny weather.

Chara algae - This advanced form of algae is more plant-like and grows attached to the bottom of a water body. Branches are rough, gritty, and give off a fish-like odour.