

# Ozone systems gaining popularity as means to clean golf course ponds

By PETER BLAIS

EDWARDS, Colo. — Every so often, Country Club of the Rockies superintendent Kevin Ross stops his utility vehicle on the bridge spanning the pond bordering the 9th and 18th holes here. He takes a couple earthworms and tosses them into the water.

The worms are just beginning to settle when out from under a rock flashes Walter, a 5-pound rainbow trout club members named after the lunker Henry Fonda finally caught in the movie *On Golden Pond*. Walter gulps his lunch and heads back home.

Ross witnesses all this through the crystal clear water running under the bridge. Members tell him several years ago he wouldn't have seen a thing. In fact, he probably would not have stopped his vehicle at all because of the odor from the pond.

"They put in an ozone system and some grass carp in the summer of 1994," said Ross, who took over the private facility a year ago. "Members have told me the situation is 10 times better than it was in the past."

Algae-choked lakes and ponds are an unsightly and smelly problem, especially in summer. Runoff

containing materials such as phosphorus, nitrate, ammonia and sulfate finds its way into the ponds and acts as fertilizer in water. The added nutrients give rise to algae blooms and rooted aquatic vegetation. Plants die and organic material settles to the bottom, decomposing and releasing more nutrients for aquatic plants and algae.

In a well-balanced system, naturally occurring bacteria decompose the organic nutrients. But as algae levels increase, oxygen levels decrease, and bacterial composition slows. With limited oxygen, other noxious gases such as methane, ammonia and hydrogen sulfide are produced. These gases cause odors that offend golfers and sometimes kill fish.

Fountains and submerged aerators have long been used to introduce more oxygen to the ponds.

In the past few years, air diffusion systems (ADS), like the one at Ross' course that place ozone along the pond bottom, have gained acceptance. Ozone consists of unstable oxygen molecules with three oxygen atoms rather than the two found naturally in air.

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The effects of treating a pond (left) with a bioaugmentation product as opposed to leaving it untreated (right) are obvious at Ridgewood Country Club in Danbury, Conn. (Photo supplied by TerraBiotics)

## Bioaugmentation offers natural alternative

The following technical bulletin was written by Jim Beer, bioaugmentation product manager for AquaScape, a Toro Co. partner. AquaScape is set to introduce an as-yet-unnamed bioaugmentation product. Several other companies market bioaugmentation materials, descriptions of which can be found on page 40.

Bioaugmentation is the process of improving water quality by the addition of naturally occurring microorganisms. Water quality is increased by alleviating such strains as organic build up, anaerobic decomposition and excessive plant and algae growth. Microorganisms such as bacteria cultures, enzymes and essential nutrients break down organic sludge, eliminate noxious by-products of anaerobic decomposition and limit plant and algae growth.

Leaves, grass, fish waste, dead aquatic plants, and airborne particles all contribute to the organic load on a pond. Depending on the amount of organics deposited in a pond and the concentration of bacteria and enzymes in the water, an undesirable sticky, black sludge may result at the bottom of the water column. Enzymes, produced by bacteria, break down organics into simple nutrients which

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## Ozone systems

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"Ozone is more reactive with water than regular oxygen," explained Bill Logan, president of Aqua Sierra Inc., which installed The Country Club of the Rockies' and 40 other golf pond systems nationwide. "It is very aggressive helping bacteria physically take apart organic matter."

Aqua Sierra's system involves injecting compressed, ozone-containing air (ozone is created by exposing air to a 185-nanometer ultraviolet light) to the lake bottom where it is dispersed through a network of polyethylene tubing weighted with quarter-inch lead thread. Bubbles emerge from the tubing pulling cold, oxygen-poor water to the surface, where it picks up more oxygen.

If run continuously, it turns over the water in a typical pond eight times a day, although systems are generally run 12 hours at a time, Logan said. This action also breaks up the thermocline, a transition zone typically found at depths of 6 to 14 feet within the water column. Within the thermocline the temperature quickly drops from as much as 70 degrees at the top to as low as 38 degrees at the bottom. The thermocline isolates the top from the bottom of the pond and allows little oxygen to pass through.

An Aqua Sierra system costs \$2,000 to \$4,000 per acre of treated pond surface. While more expensive than surface aerators, an ADS saves electricity, Logan said. A 1 1/2-horsepower compressor is sufficient to treat a one-acre pond with

ADS, whereas a surface aerator would require a 5- to 10-horsepower unit to treat the same area, he added.

Other companies manufacture and install ozone systems. Atlantic Ultraviolet Corp. of Hauppauge, N.Y., has begun marketing its Eco-Logic Pond and Lake Reclamation System. The company has tested the product in several Long Island locations for the past three years, including a tidal pond at Inwood (N.Y.) Country Club, according to Director of Marketing Ann Wysocki.

"I've noticed a definite improvement since we put it in," said Inwood superintendent Pete Ruggier. "Because it's tidal, the ocean pushes much of the algae and other debris back to the shore every day. I'm sure it would work better in an enclosed pond. I spoke to a greenkeeper who uses it in a pond at a private estate in Melville. He said the water quality used to be terrible, but now it's crystal clear. It also solved major problems at a pond in front of the IBM headquarters building in Armonk, N.Y."

RGF O<sup>3</sup> Systems Inc. has used ozone since 1985 to reduce pollutants in wastewater treatment systems. The West Palm Beach, Fla firm recently introduced its O<sup>3</sup> Aqua Aeration System to keep golf course ponds free of algae, biological oxygen demand, oils and pesticide runoff. It comes with a compressor and RGF's unique macro aeration hose, according to company literature. The golf pond unit is so new that few have been installed, said sales representative Sharon Plunkett.

## Bioaugmentation

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the bacteria use as nutrition. A variety of enzymes are necessary for the chemical break down of complex molecular organics. Lipase will break down animal or plant fats and grasses, protease attacks proteins, cellulase degrades cellulose while amylase transforms carbohydrates and starches. The results of these reactions are increased nutrient levels which are able to sustain a healthy bacteria population and a dramatic reduction in the presence of organic sludge in the pond.

Many bacterial cultures require oxygen as well as organics to survive. These organisms are classified as aerobic bacteria. Aerobic bacteria use oxygen to digest nutrients by the following simplified reaction:

Organics+Water+Enzymes = Water Soluble Nutrients + Oxygen + Bacteria = Water + Carbon Dioxide

This reaction shows the importance of oxygen and how it relates in breaking down organic waste without odorous or noxious by-products. An additional benefit of aerobic decomposition is that it is considerably quicker than anaerobic decomposition. For this reason it is highly recommended to use bioaugmentation products in conjunction with some type of aeration equipment.

Excessive aquatic plant and weed

growth in a pond is due to several factors. For plant life to flourish, the water must contain essential nutrient levels, beneficial light, carbon dioxide and be within a certain temperature range. Bacteria compete with plants for nutrients such as ammonia, nitrates, and nitrites. Bioaugmentation converts these nutrients to nitrogen gas which evaporates to the atmosphere. Therefore there are competing plants for these nutrients.

Results of one test conclude reductions in ammonia concentrations from .337 milligrams per liter, nitrate levels were reduced from .272 to .176 milligrams per liter and Kjeidahl nitrogen was reduced from 5.9 to 4.2 milligrams per liter. Other findings include significant decreases of chlorophyll (75%), phenophytin concentration (85%), and turbidity (70%). The above test is representative of only one body of water and is independent of any other pond.

It is important to realize this bacteria will continue to reproduce only when the following conditions exist:

1. A water medium containing food (organic waste).
2. Dissolved oxygen levels of at least 5 parts per million.
3. pH level between 6.5 and 8.
4. Water temperature of at least 60 degree Fahrenheit.

Bioaugmentation is one of several methods of controlling water quality.

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