Advanced Water Technologies

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Advanced Water Technologies (AWT) has introduced Live Liquid Micro-Organisms (LLMO) as an environmentally-friendly, cost-effective means for lake restoration/ beautification. LLMO is a superconcentrated source of micro-organisms that are naturally occurring in healthy aquatic systems and function to cycle nutrients. Frequently, when lakes and ponds receive excessive organic and inorganic pollutants they become stressed, interfering or subsiding nutrient cycling. The results are often low dissolved oxygen, algae blooms, unpleasant odours, excessive plant growth, and poor fish and wildlife health. AWT's Live Liquid Micro-Organisms will improve water clarity and create healthier environments for fish and wildlife.

Description of the Problem

As the number of urban water bodies steadily increases each year with the development of storm water retention ponds and small recreational lakes, the proper maintenance of these systems becomes increasingly important. In general, these urban systems are faced with high recreational use, surface runoff of high temporal variability and water quality, all in the face of enhanced public pressure to maintain aesthetics commonly associated with clean, healthy aquatic systems. Public complaints generally stem from the unsightliness of the algae, poor water clarity and musty odour. In fact, residents who purchase homes around these storm water ponds are demanding clear, clean water, while maintaining that the solutions should be environmentally-friendly.

The natural cycling of nutrients and decomposition that occur in urban aquatic systems is often disrupted by the stresses experienced by these systems. The result, internal nutrient loading and substrate accumulation. These two factors are the principal reasons that urban water systems are plagued by frequent phytoplankton blooms and an over abundance of macrophyte growth, symptoms often associated with the deterioration of aquatic health and aesthetics. These urban pond and lake systems require assistance to be brought back into balance so that the natural process of nutrient cycling and decomposition can become re-established.

Methods of Managing Bodies of Water

Although the maintenance and management of any water system must take into account many influencing factors, those factors effecting urban water systems are often common yet unique from more natural types of systems. The unnatural stressors on these water systems cannot rely on chemicals and engineering alone for a solution, but require an enhanced level of intervention more closely in tune with the processes found in nature.

The typical means to manage bodies of water include the use of herbicides and/or mechanical means to control weeds; chemicals to kill algae and improve water clarity, or a combination of all of the above. However, the use of herbicides and chemicals are environmentally suspect and appropriate only when their concentrations can be effectively controlled within narrow limits, otherwise aquatic biota are harmed or killed. Mechanical methods are often cost-prohibitive, or extremely invasive. For reducing nutrients, a variety of treatments can be applied: calcium compounds, ammonium chloride, ferric chloride, ferrous sulphate monohydrate, aeration, and live liquid micro-organisms (LLMO).

The Biology of LLMO

Aquatic systems stressed by unnatural water cycling, nutrient spikes, and altered shoreline and riparian habitat have a reduced capacity to decompose organic matter, cycle nutrients and maintain the water quality that is required to harbour a healthy aquatic ecosystem. The basis of this ecological breakdown is fundamentally at the microscopic level, where the natural bacteria in the system can no longer function. By increasing or boosting the populations of naturally occurring bacteria (Nitrosomonas spp. and Nitrobactor spp.) through seeding the lake with super concentrated bacterial suspensions, the cycling of nutrients and the rate of organic decomposition can once again be regained, while other avenues are pursued to remediate the causes of stress upon the aquatic system.

Given the increased use of fertilizers, the reduction in the number of natural marshes, the increased use of copper algaecides (which inhibit positive values of beneficial bacteria); more pollution, and the overall legislation prohibiting the use of chemical solutions, LLMO is a viable alternative. Compared to other bacterial products, LLMO has a much higher cell count per gallon (700 billion), incorporates an incubation process to enhance the growth rate of the nitrifiers, and LLMO has been manufactured since 1974 for environmental applications. LLMO (bacteria) utilize nutrients in the water, convert carbon compounds (sludge) to $C0_2$; dentrification occurs under anaerobic conditions (NO_3 to $N0_2$, to N_2); and nitrification occurs under aerobic conditions (NH_3 to $N0_2$ to $N0_3$).

The advantages of LLMO include applicator safety, improved water quality (reduced nitrogen and phosphorous), improved wildlife habitat, reduced odour, increased water clarity, decomposition of sludge and increased dissolved oxygen.

Applications in Calgary, Alberta

With the use of super-concentrated solutions of nitrifying bacteria, Advanced Water Technologies (AWT) has seeded several lakes in the City of Calgary over the past six years. Regular applications of LLMO have been effective in using up the nutrients needed for phytoplankton abundance and expediting bottom detritus decomposition.

The application process has been refined over time, beginning with the protocol which is developed for each body of water, based on its history, its problems, and whether or not it is aerated. As a start-up treatment each spring, strong concentrations of LLMO and dechlorinated water are incubated for two weeks (aerated and heated); then the mixture is

sprayed over the body of water. Over the course of the summer, LLMO is added to the incubation tanks (125 gallons), topped up with water, and then applied biweekly. All incubating product is held at 80 degrees Celsius. It is stirred vigorously prior to application, and applied within 4 hours of removal from the tanks. The process is relatively simple.

The City of Calgary field personnel have taken a strong interest in the LLMO application and have adapted the protocol provided by AWT, and then, made changes, based on weather factors, including rain, heat and cold. For example, they have been able to increase one component of the formula when hot weather has been predicted, thereby improving the water clarity. They have also been innovative and purchased an Argo, which allows them to drive onto the body of water and spray the LLMO directly onto the water. The system for pumping the LLMO from 55 gallon drums has been perfected, and all of the “set up” components have been refined.

Conclusion

Given the increased awareness of the secondary effects of chemical applications to bodies of water, the time is right for products such as LLMO, an effective means to improve water quality. However, possibly the best reason is the fact that the City of Calgary had zero complaints about the water quality in the storm water ponds treated with LLMO over the summer of 2008.