



Bio-Sterilization of Local Water Bodies

Local water bodies are essential part of villages. Local water bodies – ponds & lakes – provide water for drinking, irrigation, animal husbandry and also provide fish farming for sustainable rural economy. But stagnancy of water creates numerous ecological, health & hygiene issues.

Local water body is an ecology, which is balanced by a consortium of microorganisms, plants & live creatures. An ecologically balanced water body is where each member could support other members' growth and survival by various means, either signaling, modification of the environment to more favorable growth conditions and/or by supplying rate-limiting vitamins or nutrients. By doing so it favors the survival of the whole community, thus prolonging its beneficial attributes and making it more effective in adverse conditions. Dissolved Oxygen (DO) is an indicator of health of water body.

Dissolved oxygen (DO) refers to oxygen gas that is dissolved in water. Fish "breathe" oxygen just as land animals do. However, fish are able to absorb oxygen directly from the water into their bloodstream using gills, whereas land animals use lungs to absorb oxygen from the atmosphere.

There are three main sources of oxygen in the aquatic environment: 1) direct diffusion from the atmosphere; 2) wind and wave action; and 3) photosynthesis. Of these, photosynthesis by aquatic plants and phytoplankton is the most important.

Oxygen, derived from photosynthesis, is produced during the day when sunlight shines on the plants in the water. Oxygen levels drop at night because of respiration by plants and animals, including fish. These predictable changes in DO that occur every 24 hours are called the diurnal oxygen cycle (Figure 1).

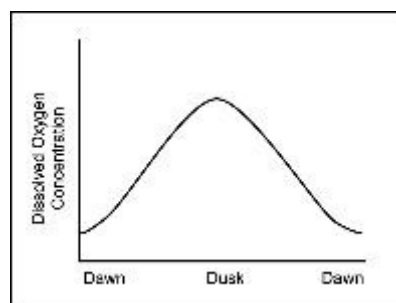


Figure 1.

Dissolved oxygen concentration in ponds fluctuates on a 24-hour basis. This fluctuation is called a diurnal oxygen cycle. Dissolved oxygen increases during daylight hours when photosynthesis is occurring and decreases at night when respiration continues but photosynthesis does not.

Oxygen depletion refers to low levels of DO and may result in fish mortality. A concentration of 5 mg/L DO is recommended for optimum fish health. Sensitivity to low levels of dissolved oxygen is species specific, however, most species of fish are distressed when DO falls to 2-4 mg/L. Mortality usually occurs at concentrations less than 2 mg/L. The number of fish that die during an oxygen depletion event is determined by how low the DO gets and how long it stays down. Usually larger fish are affected by low DO before smaller fish are.

Oxygen depletion occurs when oxygen consumption exceeds oxygen production. Increases in oxygen consumption can be caused by an over-abundance of aquatic plants or algae in the ecosystem, "turnover" of a body of water (see Stratification/Pond Turnover section), increased organic waste entering the water (i.e., manure from feedlots, septic tank waste water, and excess fish feed), death and decay of organic matter (i.e., plant or algae die-offs), or by certain chemicals (i.e., formalin) that remove oxygen directly from the water column.

Remedial Actions:

Aeration by mechanical equipment is the most common way of increasing DO level of water. For commercial purpose, this method is viable & sustainable. For community purpose, bio-Sterilization or biological remediation is the way out.

Bio-Sterilization is a remedial method where microbes are applied to improve DO of water. Application of Gram Positive (Gram +ve) microbe controls the decomposition of waste within water and produces vitamins, nutrients and organic acids to control the growth of Gram Negative (Gram -ve) microbe. Domination of gram +ve microbe (pathogen or harmful microbe) balances the water ecology and improves DO to enhance aqua ecosystem.

There are number of microbial cultures or consortiums are available for direct application over pond water for **Bio-Sterilization**. But, such applications are costly and cannot be sustainable for communities.

Bio-Sterilization for communities should be a part of solid and/ liquid waste management. Community solid waste – kitchen waste, animal husbandry waste, market waste etc should be treated by consortia to convert into a stable compost. Stable & odourless compost carry 1.0-10.0 crore gram +ve microbes per gram. Such a large population of gram +ve microbes through compost will be applied to the wet land around local water bodies and also to the water. Presence of gram +ve microbes will slowly control the growth of pathogen and dominate the water ecology.

Quantity of compost required will be approximately 10 kg/ 1.00 lakh litre / week initially.

Initially, the **Bio-Sterilization** should be done on weekly basis and after rechecking the DO level, frequency can be reduced.

Bio-Sterilization will bring in following changes in the water bodies:

1. Controlled decomposition of organic waste within water will lead to DO level
2. Generation of primary & secondary metabolites will enhance signalling between gram +ve colonies to thwart the growth of pathogen
3. Controlled decomposition will decrease haziness of water and improve clarity of water
4. Improved clarity of water to penetrate more sunlight to enhance photosynthesis
5. Fish mortality will be reduced