

ANNEXURE – 1 (CASE STUDY IN WATER BODY RESTORATION)

LAKES AND WATER BODIES

THE PROBLEM

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EUTROPHICATION

Continuous dumping of waste into natural water bodies results in eutrophication. Increased nutrients enhance growth of nuisance algae to cover the water surface cutting off light which results in anaerobic conditions developing in polluted water bodies. This condition leads to depletion of oxygen in a body of water, which kills aquatic animals. It is a natural response to the addition of excess nutrients, mainly phosphates, which induces an explosive growth of blue-green algae (Cyanobacteria), the decaying of which consumes oxygen from the water. One example is the "bloom" or great increase of certain types of phytoplankton in a water body as a response to increased levels of nutrients. Eutrophication is almost always induced by the discharge of phosphate-containing detergents, fertilizers, or sewage, into an aquatic system.

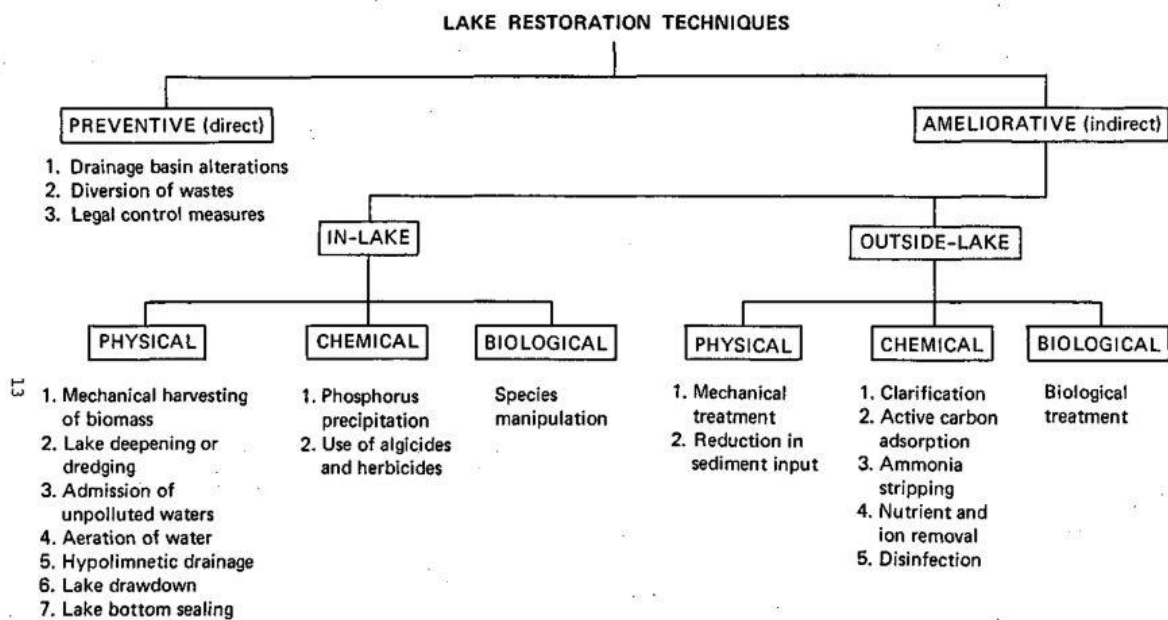
Blue - green algae have the unique ability to fix nitrogen from the atmosphere. They are also known to produce siderophores which can chelate and scavenge iron and make it unavailable to other algae. This leads to elimination of useful algae and domination of blue green algae upsetting the ecosystem completely. In nitrogen limiting environments, these alga tend to flourish and dominate the eco-system of the water body. A natural balance is always maintained in the pond eco-system, with the zooplanktons feeding off the phytoplankton which in turn are consumed by the fish.

Blue-green are hardly consumed by zooplanktons, which mainly prefer to consume green alga and diatoms. Inability to consume blue green alga leads to an exploding population of the latter. Moreover, these algae, after they die, settle at the bottom of the pond and rot, leading to an increase in BOD in the water and bringing down the Dissolved Oxygen levels in the water significantly. The excess blue-green alga sucks

out the oxygen at night, leading to a depletion in the levels of aerobic bacteria. In these conditions, anaerobic bacteria thrive, giving out H₂S and Methane, which results in foul odor in the pond.

LAKE RESTORATION :

Restoration of polluted lakes involves several stages depending upon the condition of water body. Removal of suspended solids (TSS), elimination of dominating toxic blue green algae (Cyanobacteria), introduction of robust and beneficial micro algae along with a few selected symbiotic bacteria, increase in dissolved oxygen, odour removal, increased transparency of water, revival of normal food chain starting from algae, zooplankton and fish.



A combination of physical and biological methods works better in most of the cases. When sufficient space is not available near the lake *ex situ* treatment may be difficult. In situ treatment involving biological species manipulation works like magic in most of the cases. Selection and introduction of robust and efficient species is crucial for the success of the process.

THE SOLUTION

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PHYCOPLUS

Phycoplus is a unique solution tested and developed by our group to especially meet the above challenge. It consists of 3 ingredients:

- a) Live micro algae consortium
- b) Live bacteria consortium
- c) Micro-nutrients

This product is in the form of a gel with highly concentrated algal cells and one sachet has 10 billion algal cells which are robust and rapidly growing species. This product is stabilized to have longer shelf life. The consortium consists of algal strains that have the capability to dominate over blue-green alga.

How it works

Phycoplus consists of robust and rapidly dividing selected natural green micro algae along with symbiotic bacteria and micro nutrients. When introduced into polluted water bodies the algal consortium establishes itself with the help of associated beneficial bacteria which act upon toxic organic loads and mineralize. The mineralized nutrients are taken up by micro algae which do photosynthesis by capturing CO₂ and releasing valuable oxygen. Symbiotic bacteria are encouraged by the oxygen released by micro algae to rapidly degrade pollutants and bring the water body to normalcy at a faster pace. Micro algal consortium would also interfere with the advantage provided by siderophores of blue green algae by nullifying the effect and eliminating the nuisance blue green algae resulting in increased transparency and dissolved oxygen of water.

There are a host of micro-nutrients which in trace amounts and in the available form can trigger the growth of green alga. The micro-nutrients present in Phyco-plus boost the

growth of green alga as well as diatoms, enabling them to dominate over blue green alga. Once these unicellular algae dominate, they are easily taken up by the zooplanktons and enter into the food chain. Therefore they do not accumulate and cause an environmental hazard to the lake.

APPLICATION & DOSAGE

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One unit of this product is mixed with water and distributed over one acre of pond or lake area. The algal cells start dividing immediately taking nutrients from water bodies. Due to photosynthetic activity water gets oxygenated, nuisance algae get eliminated and water becomes more transparent. The symbiotic bacteria associated with the algal cells act on the organic load of waste water and mineralize. Growth of algae in water slowly remediates and the water bodies return to normalcy quickly. This product has been tested extensively in fish ponds in Andhra Pradesh as well as in a lake in Aligarh. The results are attached herein.

DOSAGE

Each UNIT Contains 10 Billion Green Algae Cells

Dosage: Initial dosage to be decided based on monitoring; after lake returns to normalcy - one UNIT/acre monthly once

Usage: Mix Phycoplus with sufficient water and spread evenly all over the pond. Preferably dose during morning times. Ensure proper mixing of culture throughout the water body.

OUR CREDENTIALS - CASE STUDY OF LAKE RESTORATION

Mainath is a small village located 10 kms from Aligarh. Consisting of a population of not more than 200 families, Mainath had a very severe water problem. Mainath does not have a sewerage or sewage treatment system. There is a common pond in the village whose area would be a little over an acre. As expected, the pond was very highly contaminated, with a high BOD load and high concentration of Coliform Bacteria and E.coli.

“People in the village do not have toilet facilities, so they go to defecate in the open. During the rainy season, the run-off from the open defecation areas is channelized into the village pond. The domestic wastewater from cooking and cleaning of individual families also flow into the pond.”

Shankarlal, Gram Pradhan, Mainath Village, UP

- *“About 4 years back, the villagers found that the animals were dying after drinking the water from the pond. UP Jal Nigam had tested the water from the pond and had advised us not to use it for any purpose. We believe that the pond is also contaminating our ground water. Now, people drawing water from the ground water table are also complaining of various ailments. One of the reasons could be that this water is seeping down and mixing with the ground water table.”*

Tanuja Deshraj, MA (Botany), Community Leader, Mainath, UP

POND BEFORE TREATMENT



Chemical Parameters (Complete Report available in separate Annexure)

Colour,	Light Yellow	-	Visual
Odour	Disagreeable	-	IS:3025 (P-5)
Turbidity, NTU	2213	-	IS:3025 (P-10)
pH Value	7.31	5.5 – 9.0	IS:3025 (P-11)
Total Hardness (as CaCO ₃), mg/L	180	-	IS:3025 (P-21)
Total Alkalinity, mg/L	265	-	APHA 22 nd Edt.
Total Dissolved Solids, mg/L	392	-	IS:3025 (P-16)
Magnesium (as Mg), mg/L	19.44	-	APHA 22 nd Edt.
Dissolved Oxygen,	1.62	-	IS:3025 (P-38)
Sulphate (as SO ₄), mg/L	3.6	-	APHA 22 nd Edt.
COD, mg/L	900	250	APHA 22 nd Edt.
BOD, mg/L	220	30	APHA 22 nd Edt.
Nitrate, mg/L	1.8	10	APHA 22 nd Edt.
Oil & Grease	<2	10	APHA 22 nd Edt.
Total Suspended Solids, mg/L	4720	100	IS:3025 (P-18)

Microbiological Parameters :

Total Coliform, MPN per 100ml	5.0x10 ⁵	-	APHA 22 nd Edt.
E.coli, MPN/100ml	2.1x10 ³		APHA 22 nd Edt.

TREATMENT THROUGH PHYCOPLUS



Phycoplus and the nutrients are mixed thoroughly and sprayed into the pond. The difference is visible in a week's time and within 2-3 weeks time, the difference is significant.



Each dosage was carried out 3 days apart. Results were quite vivid by the 4th dosage.

POND RESULTS AFTER TREATMENT FOR A MONTH

POND RESTORATION THROUGH USE OF MICRO-ALGAE



PARAMETERS	BEFORE TREATMENT	AFTER TREATMENT	% REDUCTION
COD	900 PPM	80 PPM	90.0%
BOD	220 PPM	16 PPM	92.7%
TURBIDITY	2213 NTU	11.71 NTU	99.4%
TOTAL COLIFORM (MPN PER 100 ML)	5×10^5	1.6×10^3	99.7%
E.COLI (MPN PER 100 ML)	2.1×10^3	8	99.6%

- *“After treatment has begun, 75% of the greenish layer on top of the pond has disappeared automatically. Earlier the pond would stink at certain times. Now the smell is gone completely. The water has become more transparent also.”*

Tanuja Deshraj, Community Leader, Mainath