

PHYSICO-CHEMICAL QUALITY OF WATER OF FISH POND



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Physico-chemical quality of water of fish pond

- Water provides physical support for fishes to carry out their life functions such as feeding, swimming, breeding, digestion and excretion.
- Physico-chemical and biological factors of water may directly/indirectly affect its quality and consequently its suitability for the distribution and production of fish and other aquatic animals.
- Any changes in the environment add stress to the fish and the larger and faster the changes, the greater the stress.

1. Temperature:

- As fish is a cold blooded animal.
- Its body temperature changes according to that of environment affecting its metabolism, physiology and ultimately the production.
- Higher temperature increases the rate of bio-chemical activity of the micro-biota, plant respiratory rate and so increase in oxygen demand.
- It further cause decreased solubility of oxygen and also increased level of ammonia in water.
- Suitable water temperature for Carp culture is between 24-30⁰C.

Remedies:

- By water exchange,
- Planting shady trees or making artificial shades during summer's thermal stratification can be prevented.
- Mechanical aeration can prevent formation of ice build-up in large areas of the pond.



2. Turbidity:

- Ability of water to transmit the light.
- Turbidity restricts light penetration and limit photosynthesis.
- Depends on suspended clay particles, dispersion of plankton organisms, particulate organic matters and also the pigments caused by the decomposition of organic matter.
- Turbidity range from 30-80 cm is good for fish health.

- The Secchi Disk (used to measure the penetration of light) transparency between 30 and 40 cm indicates optimum productivity of a pond for good fish culture.

Remedies:

- Addition of more water.
- or lime at a rate of 20 mg/L
- Gypsum on the entire pond water at rate of 200 Kg/1000m³ of pond can reduce turbidity.



3. Water Colour:

- Pale colour, light greenish or greenish waters suitable for fish culture.
- Dark brown colour is lethal for fish culture and clear water is unproductive for fish culture.
- The abundance of phytoplankton and zooplankton is responsible for the determination of colour of an aquatic body

Remedies: Application of organic and inorganic fertilizers in clear water ponds may increase productivity.

4. Dissolved Oxygen (DO):

- Dissolved oxygen affects the growth, survival, distribution, behaviour and physiology of shrimps and other aquatic organisms.
- The principal source of oxygen in water is atmospheric air and photosynthetic planktons.
- Solubility of oxygen in water decreases with increase in temperature; increase in salinity; low atmospheric pressure, high humidity, high concentration of submerged plants, plankton blooms.
- Oxygen depletion in water leads to poor feeding of fish, starvation, reduced growth and more fish mortality.

Indication of low Dissolved oxygen:

- If fish comes to the surface of water and Secchi Disk reading falls below 20 cm, fish swim sluggishly and are weakened.
- DO between 3.0-5.0 ppm in ponds is unproductive and for average or good production it should be above 5.0 ppm.

Remedies:

- Avoid over application of fertilizers and organic manure.
- Physical control of aquatic plants.
- Recycling of water, use of aerators and manually beating of water.
- Avoid overstocking of fishes.

5. Biological oxygen demand (BOD):

- BOD is the measurement of total dissolved oxygen consumed by microorganisms for biodegradation of organic matter such as food particles or sewage etc.
- The BOD level between 3.0-6.0 ppm is optimum for normal activities of fishes;
- 6.0-12.0 ppm is sub-lethal and >12.0 ppm can usually cause fish kill due to suffocation.

Remedies:

- Adding lime, water stabilize before stocking.

6. Carbon-dioxide (CO₂):

- Free carbon dioxide, highly soluble gas in water,
- Main source of carbon pathway in the nature,
- Contributed by the respiratory activity of animals and can exist in water as bicarbonates/carbonates.
- When dissolved in water, it forms carbonic acid which decreases the pH of any system, which is harmful for aquatic organisms.
- Fish can tolerate concentrations of 10 ppm provided DO concentrations are high and water supporting good fish populations normally contain less than 5 ppm of free CO₂.

Remedies:

1. Proper aeration to blow off the excess gas.
2. Reduce organic load by adding more water (no fish) and add Muriatic acid/swimming pool acid to adjust the pH to about 5.
3. Use of lime (CaCO_3) or sodium bicarbonate (NaHCO_3)
4. Application of potassium permanganate at the rate 250 g for 0.1 hectare.

7. pH:

- The pH of natural waters is greatly influenced by the concentration of carbon dioxide which is an acidic gas.
- Fish have an average blood pH of 7.4.
- Generally 7.0-8.5 is more optimum and conducive to fish life.
- Fishes can become stressed in water with a pH ranging from 4.0 to 6.5 and 9.0 to 11.0.
- Death is almost certain at a pH of less than 4.0 or greater than 11.0.

Remedies: Add gypsum (CaSO_4) or organic matter and use of quicklime (CaO) to rectify low pH of water.

8. Hardness:

- Hardness is the measure of alkaline earth elements such as calcium and magnesium in an aquatic body.
- Calcium and magnesium are essential to fish for metabolic reactions such as bone and scale formation.
- The recommended ideal value of hardness for fish culture is at least 20 ppm and a range of 30-180 mg/L.
- Hardness values less than 20 ppm causes stress, 75-150 ppm is optimum for fish culture and >300 ppm is lethal to fish life.

Remedies: Add quicklime/alum/both and add zeolite to reduce hardness and avoid the runoff water to fish pond.

9. Ammonia (NH₃):

- Ammonia is the by-product from protein metabolism excreted by fish and bacterial decomposition of organic matter such as wasted food, faeces, dead planktons, sewage etc.
- Ammonia in the range >0.1 mg/L tends to cause gill damage and destroy mucous producing membranes.
- Sub-lethal effects like reduced growth, poor feed conversion and reduced disease resistance at concentrations that are lower than lethal concentrations, osmoregulatory imbalance, kidney failure.
- Fish suffering from ammonia poisoning generally appear sluggish or often at the surface gasping for air.

Control and treatments:

- Increase pond aeration.
- Addition of liming agents.
- Formaldehyde and zeolite treatment.
- Regular water change out.

10. Primary productivity:

- This is the rate at which photosynthesis takes place.
- The most commonly used index of productivity is the DO content of the water.
- The primary productivity ranges 1.60-9.14 mg C L⁻¹ D⁻¹ (GPP) as optimum status.
- A fish pond can be considered good in productivity if it is slight green in colour, with no scum on the surface and having a transparency of about one foot.
- Primary productivity can be estimated by measuring the chlorophyll from the algal biomass.

Remedies: use of organic/inorganic fertilizers in ponds.

11. Plankton:

- Those aquatic pelagic organisms, which are carried about by the movement of the water rather than their own ability to swim are called planktons.
- The plant components are called as phytoplankton and animal components as zooplanktons and they serve as fish food organisms.
- For enumeration, they are collected using plankton net.
- As plankton is at the base of the food web, there is a close relationship between plankton abundance and fish production.

How to detect pond water of poor quality



- Clear water indicates very low or absence of biological production- not fertile enough and fish will not grow well in it.
- In muddy water, fish can have their gills blocked by the soil particles and this can result in death - not good for fish culture.
- Deep green water indicates over-production of planktons that serve as food for fish.
- It occurs as a result of application of more than enough fertilizers, manure or nutrient rich feeds to a pond.

- When a fish pond gives an offensive odour, it indicates pollution of pond water.
- Sources of pollution include application of excess food stuff to the pond or inflow of water from polluted rivers.
- Pollution can also result from application of chemicals to arable crops around the pond site.
- In an already stocked fish pond, if a farmer noticed the fish always struggling at the pond water surface to get oxygen, then there is low DO content in the water.



THANKS

