



“ROLE OF CHEMICAL PROPERTY OF POND WATER IN SUPPORTING LIFE”

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INTRODUCTION

The life supporting capability of pond water can be determined by the chemical characteristics. The important chemical factors, which influence the pond productivity, individually or synergistically are pH, dissolved oxygen, free CO₂, total alkalinity, salinity and other dissolved nutrients. India has a total potential for fish culture of about 3.6 million hectares, of this fresh water covers 1 million hectares. Fresh water ponds are important site of pisciculture in rural area. There are various unique properties of water which make it especially suitable for supports of life. The world use of edible and non-edible fishery products was 16.3 kg person in 1983. With an estimated world population of 7.35 billion in the year 2019, an unchanged per capita use would require a supply of approx 110 million metric tons. Increased demand for inexpensive and renewable protein sources for rapidly expanding population is considered the catalyst for fisheries development.

Total fishery production in Haryana is Approximately 80-90000 tonnes/year. Seasonal fluctuations of various chemical factors mediated due to various factors like morphometry etc. have an important role in the distribution periodicity qualitative and quantitative composition of biota in an aquatic ecosystem. The knowledge of all these factors is essential for identifying the suitability and fertility of an aquatic ecosystem.

Water is abode of fish ever since appeared on the face of earth some 450 million years ago. Fishes seems to have attained mastery in living in water, having adapted to all conditions from deep sea to torrential streams, from desert pools to cave waters from sub-terranean waters to coral reefs, from frozen waters of Antarctica to hot waters. Indeed they occupy all possible habitats in water which covers nearly ¾th of earth's surface today. The biology of fish cannot be understood in isolation from the surrounding water. We have read the many instances of regulation of the internal concentration of various dissolved materials by fish, but anyone may be misled in to thinking that only ions can diffuse in to or out of fish. This is not true.



Thus anyone concerned with the health of fish must be concerned with water quality. As we know distilled water, contains no toxicants but has none of the minerals needed to keep fish alive either, thus some kind of minerals and other important ions are at least necessary to enhance the fish production in stocking pond.

The pond we have selected for our study has composite fish culture going in it. Fishes present in Pond are –

Labeo rohita – rohu, Cirrhina mrigala – mrigala

Hypophthalmichthys – Silver Carp, Ctenopharyngodon idella – Grass Carp

Cyprinus carpio – Common Carp

To examine various physio-chemical characteristics of pond, suitable methods were employed. The observations were made monthly from June to Nov. 2019, and were compared with standard for pisciculture.

All metabolic and physiological activities and life processes are influenced by temperature. In present study, the mean temperature comes out 26.16°C with range 19°C to 32°C. The grass carp is known to stand 40°C temperature. The silver carp however shows signs of distress at 40°C. Both species prefer temperature range is 18.3 – 37.8°C in which present calculated range lies.

Swingle (1967) stated that waters having a pH range of 6.5 to 9.0 as recorded before day break are most suitable for pond culture and those having pH values more than 9.5 are unsuitable because in latter CO₂ is not available. Fish dies at about pH 11.

In present study range goes 7.6 to 8.5 with a mean value of 8.13, which is best for pisciculture.

Dissolved oxygen received by pond by two sources :

- 1 By absorption from atmosphere at surface of pond.
- 2 By photosynthesis of the chlorophyll bearing organisms inhabiting the pond.

Mean value of D.O. is 7.5 mg/l with a range of 6.5 to 8.2 mg/l. Minimum amount of D.O. was recorded during summer month i.e. at high temperature due to

- 1 Mud metabolism
- 2 Metabolism of biotic macro invertebrates and vertebrates (fishes)



3 Scum formation and cessation of photosynthesis due to algal cover on some places on water surface.

The permissible limit of D.O. for pisciculture is 4 – 10 mg/l. Observed value range in between this.

Minimum value was obtained in month of June i.e. 6.5 mg/l and maximum was obtained in month of November i.e. 8.2 mg/l.

Carbon oxide is one of the essential constituents of an aquatic ecosystem. The abundance of CO₂ exerts certain specific effects on aquatic biota. The pond exhibited maximum 4.5 mg/l and min 3.2 mg/l the mean value for F CO₂ will be 3.8 mg/l in the study.

According to standards of pisciculture the range must lie between 3-7 mg/l and observed value fall in this suitable range.

Chlorides have mean value of 127.7 mg/l for study pond and range between 107.8 mg/l to 145.3 mg/l. Variability among chloride concentration is not following any specific pattern but in general it is giving approximately negative correlation with D.O. of pond. The pond water is free from severe pollution and is optimum and safe for pisciculture according to our study.

RESULTS AND DISCUSSION

The Physiochemical characteristics of water of stocking pond were estimated in order to test its compatibility for fish culture. Results are shown in table No. I and II. The values obtained were compared with the standards for pisciculture.

PH

In general all the months of testing the water sample was alkaline in nature. The pH range from 7.6 to 8.5.

Temperature

During the present investigations the temperature of pond water varied from 32⁰C to 19⁰C, corresponding values are shown Table 1.

Dissolved Oxygen

Fluctuations in D.O. contents are quite noticeable among study months. D.O. vary from 6.5 mg/l to 8.2 mg/l.

Free CO₂ content



Free CO₂ content of pond water vary from 3.2 mg/l to 4.5 mg/l corresponding values are shown in Table 1.

Chlorides

Chlorides in water samples of pond in different months have shown variation 107.8 mg/l to 145.3 ml/ltr. As shown in table 1.

Temperature

Temperature has considerable influence on the principle and vital activities of fish notably their breathing, growth and reproduction. Some species of fish like carp which are cultured in the study pond can withstand wide range of temperature as low as 10⁰C. Fishes can breathe normally in an environment with sufficient O₂, which is tied to the temperature. At low temp., D.O. is high as compared to high temperature. For carp optimum temperature is 25⁰C to 28⁰C. Even young carp can feed at 4⁰C.

Reproduction of fish depends on water temperature. At high temperature spawning is high. So in tropical regions (where temp. 22⁰C average) fish yield is 3 times greater than pond of temperate region (where temp is 10⁰C approx.)

The Best Water for fish cultivation is neutral or slightly alkaline, with a pH between 7 and 8. In the high alkanility the pH varies less.

D.O.

Vegetation have a considerable influence on the dissolved oxygen content in the ponds if it is too dense. During day it can give off excess of O₂ to a point of saturation. At night the same vegetation absorbs oxygen and can bring the O₂ down to minimum level.

The dissolved O₂ needs of fish vary according to species, Carps, rohita can easily breath in D.O. 6 to 8 mg/l our research value corresponds this value.

Chloride Content

In the reservoir water chloride content ranged from 107.8 mg/l to 145.3 mg/l. In present study it was found that no fixed trend of variation could be ascertained, which may be due to precipitation, evaporation, human activity and waste disposal.

In present study all the parameters studied are under optimum limits for the pisciculture as governed by the norms of pisciculture. All the mean values lie within permissible limit so according to this research Nonand pond is fit for pisciculture.

Free CO₂

CO₂ in natural water is derived from various sources Viz. (I) the atmosphere (II) respiration of animals and plants (III) Bacterial decomposition of organic matter (IV) inflowing ground waters which seep into ponds, lakes and streams, the amount of CO₂ depending upon the top soil & (V) finally from within the water itself in combination with other substances chiefly Ca and Mg.

The free CO₂ which is necessary to retain Ca²⁺ in solution in the form of calcium bicarbonate is called equilibrium carbon dioxide or free carbon dioxide. Range of F CO₂ is from 3.2 (minimum) during winter month to 4.5 (Maximum) in summer month. D.O. and FCO₂ go inversely to each other, which is depicted by this study also.

The fall in free CO₂ during winter months is surely due to weak/low metabolic activities of fishes present in pond.

Table – 1

Physio-chemical characteristics of water of fish stocking pond

Month 2019	Parameters					
	PH	Temp.	D.O. (mg/l)	FCO ₂ (mg/l)	Total hardness (mg/l)	Chlorides (mg/l)
June	8.1	32	6.5	4.5	229.7	145.3
July	7.6	31	6.8	4.2	235	136.7
August	8.0	28	7.4	3.9	217.9	115.8
September	8.4	25	8.1	3.5	189.3	129.7
October	8.5	22	8.2	3.7	176.5	131.1
November	8.2	19	8.2	3.2	198.7	107.8



Table – II

Mean values of chemical characteristics of water of fish stocking pond in District Mahendergarh (Haryana) June-November (2019)

Parameters	Values	Mean value \pm S.D.
Temperature	19-32	26.16 \pm 4.66
	7.6-8.5	8.13 \pm .29
Dissolved Oxygen (mg/l)	6.5 – 8.2	7.51 \pm .68
Free CO ₂ (mg/l)	3.2 – 4.5	3.8 \pm .43
Total Hardness (mg/ltr.)	176.5 – 235	207.8 \pm 21.31
Chloride Content (mg/ltr.)	107.8 – 145.3	127.7 \pm 12.54



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