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Assessment of physico - chemical parameters of freshwater ponds of district Bijnor (U. P), India

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Abstract
The present study was conducted to assess the physico-chemical parameters of freshwater ponds of district Bijnor (U. P), India during August 2016 to January 2017. Analysis was performed on 11 different parameters. The results showed that the pH ranged from 9.00-11.00; DO 8.0-16.0 mg/l; BOD 2.0-6.0 mg/l; COD 14.5-15.0mg/l; total dissolved solids 84 - 86 mg/l; total hardness 100 - 450 mg/l; calcium 140- 150 mg/l; magnesium 46- 120 mg/l; chlorides 38.90- 40.30 mg/l; nitrites 0.02-0.21 mg/l; alkalinity 54-198 mg/l in all selected ponds. The results showed that the domestic wastes, industrial wastes, fertilizers etc. are man-made pollutants of water in the present study area. Some natural causes are biodegraded portion of animals and plants to fish, siltation by erosion of soil etc.

Keywords: Freshwater environment, water quality, fish production, pollution, water quality

Introduction

The role of water in nature is unique not only from the point of human consideration; even the numerous organisms make aquatic medium their abode. Understanding such aquatic life requires a sound knowledge not just for organisms themselves but also of those of external influences of the medium that affect them [1]. The variation in the physico-chemical parameters of the ponds above or below standard values has potential effects on the health and production of fish. The optimum fish production is totally dependent on the physical, chemical and biological qualities of water to most of extend.

Bijnor, or more correctly Bijnaur, occupies the north-west corner of the Moradabad Division (historically, Rohilkhand or Bareilly region), and is a roughly triangular stretch of country with its apex to the north. The district has a pleasing climate with cool and foggy winter and generally hot and humid summer. The wet session starts from July to October during which the district receives rainfall. The temperature of the district is varies from 48℃ in summer and 3℃ in winter [2].

Water quality is first important limiting factor in pond fish production. Water quality generally means the component of water which must be present for optimum growth of aquatic organisms. The determinant of good growth in water body includes dissolved oxygen, hardness, turbidity, alkalinity, nutrients, temperature, etc. In most water bodies, various chemical parameters occur in low concentrations. Several studies have been made on the limnology and aquatic system of fresh water bodies [3-24]. Among animal species, the fishes are inhabitants which can be highly affected by toxic pollutants. The domestic wastes and untreated or partially treated industrial effluents, supplemented with pollutants like heavy metals, pesticides and many organic compounds, have greatly contributed to massive fish death of aquatic ecosystems. These toxic chemicals and metals have changed the quality of water that affects the fish and other aquatic organisms [25]. Many freshwater species are precipitously declining and impoundments brought about by rapid human population growth [15, 26].

The present study was carried out to evaluate the magnitude of physico-chemical and biological parameter of water in different water sources with a view to assess its suitability for fish culture in the freshwater ponds of district Bijnor (U. P., India).

Materials and Methods

The present study was conducted on 10 ponds during the period of six months (August 2016 to January 2017) to evaluate the magnitude of physico-chemical and biological parameter of water in ponds with a view to assess its suitability for fish culture in the freshwater ponds of

district Bijnor. In the present work, water samples were collected from different water ponds of Bijnor (29.3721° N, 78.3842° E) from different parts of the study area and various physico-chemical analyses were performed based on standard methods(APHA, 1998). To know the effect of water pollution on fish production water samples collected were analysed.

Sampling location

The study area (District Bijnor) is located in the western part of the state Uttar Pradesh (India), on the banks of the Ganga River. Different ponds were selected for samples collection because these ponds were highly polluted with organic and inorganic pollution. These were named as Pond 1 and Pond 2, Pond 3, Pond 4, Pond 5, Pond 6, Pond 7, Pond 8, Pond 9 and Pond 10 to differentiate during documentation. Map of the study area is shown in figure (Fig.1 A, B).

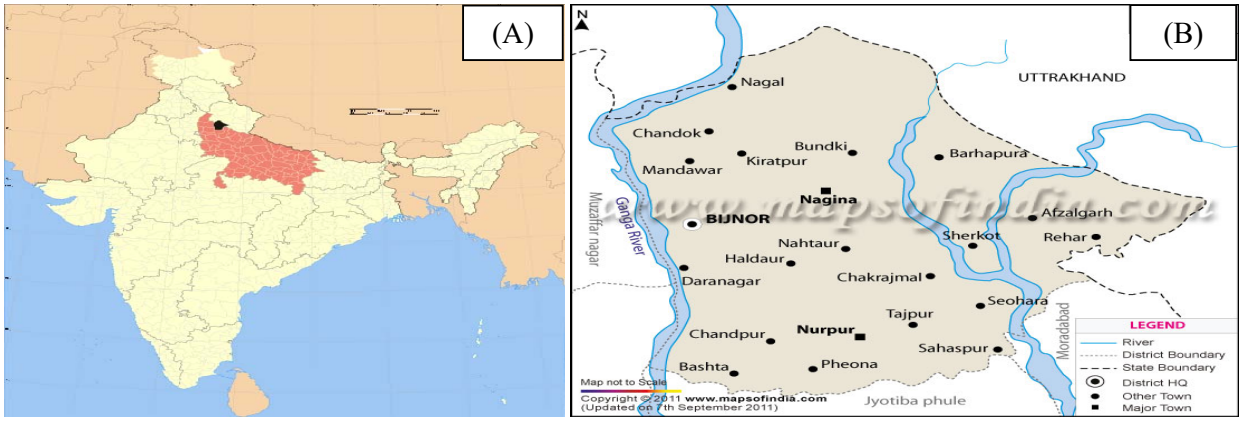

Fig 1: (A) Location of state U. P in India Map (B) Map of the district Bijnor showing Ganga River and various areas of district [27].

Data Collection and Analysis

To know the quality of water for fish survival water samples from different sampling points were collected and immediately taken to the laboratory and stored in a refrigerator at 4°C and analyzed for eleven different parameters e.g., Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), dissolved oxygen (DO), Total dissolved solids (TDS), pH, Total Hardness, Calcium, Magnesium, Chloride, Nitrites and Alkanity using standard methods of analysis [28].

Water samples were collected by lowering precleaned plastic bottles into the bottom of the water body, 30cm deep, and allowed to over flow before withdrawing and during morning hours between 7.00 am to 11. 00 am. Sampling points are approximately 100m away from each other. Samples were collected in all the 6 month. Physico-chemical parameters like pH, TDS, were analysed on the spot with the help of water analysis kit while remaining other parameters were analyzed in the laboratory by standard methods [28].

All the water samples were analysed using standard methods and parameters. The values obtained were compared with values recommended in water quality standards of WHO [29] BIS [30].

Results and Discussion

The mean value of the physico-chemical parameters (Table1) of samples were compared with WHO standard parameters for drinking water quality. The result revealed that the domestic waste and sewage were the main source of water pollution. The water of these ponds was used for washing clothes, drinking of cattle, bathing purpose. The result revealed that this was not suitable for bathing and drinking but in most of the ponds the production is good and several species inhabit this region. The results also revealed that most of the physico- chemical parameters were good for fish culture but the value of physico- chemical parameters indicated that this water is not suitable for drinking purpose.

The physico- chemical parameters and their range value of these ponds was as follows:

pH: The pH variation exerts heavy stress on the inhabitant organisms in the aquatic media. The pH ranged from 9.0-11.00 in all selected ponds (Table 1) during the study period and kept fluctuating irrespective of the months in the entire stretches of the ponds.

In the present study, most of the values of parameters exceed the desirable limit according to the fluctuation in optimum pH ranges may lead to an increase or decrease in toxicity of water bodies.

Dissolved oxygen (DO): Dissolved oxygen (DO) plays an important role in aquatic environment and is essential for growth of fish production. The DO ranged from 8.0-16.0 mg/l in all selected ponds. Oxygen depletion in water leads to poor feeding of fish, starvation, reduced growth and more fish mortality, either directly or indirectly [31]**.** The present study revealed that DO was remained constantly undisturbed during the study. Dissolved oxygen affects the growth, survival, distribution, behavior and physiology of shrimps and other aquatic organisms [32].

The principal source of oxygen in water is atmospheric air and photosynthetic planktons. Obtaining sufficient oxygen is a greater problem for aquatic organisms than terrestrial ones, due to low solubility of oxygen in water and solubility decreases with factors like- increase in temperature; increase in salinity; low atmospheric pressure, high humidity, high concentration of submerged plants and plankton blooms.

Biochemical oxygen demand (BOD): BOD of fish ponds ranged from 2.0 - 6.0 mg/l in all ponds. Biochemical oxygen demand (BOD) is a measure of oxygen required by microbes to degrade the organic matter under aerobic condition. BOD increases with the increased inflow of the domestic waste. High BOD depletes the oxygen level to a critical condition thus indicating the pollution status of waters. According to Bhatnagar *et al.* [33] the BOD level between 3.0-6.0 ppm is optimum for normal activities of fishes; 6.0-12.0 ppm is sublethal to fishes and >12.0 ppm can usually cause fish kill

due to suffocation. Bhatnagar and Singh [34] suggested the BOD <1.6mg L-1 level is suitable for pond fish culture and according to Ekubo and Abowei [35] aquatic system with BOD levels between 1.0 and 2.0 mg L-1 -considered clean; 3.0 mg L-1 fairly clean; 5.0 mg L-1 doubtful and 10.0 mg L-1 definitely bad and polluted.

Chemical Oxygen Demand: The present study revealed that COD ranged from 14.5-15.0 mg/l. The most common application of COD is in quantifying the amount of oxidizable pollutants found in surface water (e.g. lakes and rivers) or wastewater. WHO [29] suggested the value of chemical oxygen demand should be 10mg/l, but in the present study the value exceed the desirable limit. So the water of these ponds is not suitable for drinking purpose.

Total Dissolved Solids: In the present study TDS values were found below the standard permissible limit which accounts for its palatability. The present study indicates that TDS ranged from 84-86 mg/l. The BIS [30] has set desirable limit of TDS value to be 500 mg/l in potable water. However the permissible limit is 2000 mg/l in the absence of any alternative source in water. According to WHO [29], the standard permissible limit for TDS is 1000 mg/l. Water at a TDS level of above 500 mg/l is not suitable for flora and tastes unpleasant to drink.

Total Hardness: The present study revealed that hardness ranged from 100- 450 mg/l. Hardness is the measure of alkaline earth elements such as calcium and magnesium in an aquatic body along with other ions such as aluminium, iron, manganese, strontium, zinc, and hydrogen ions. 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 [36] and a range of 30-180 mg L-1 [21]. According to Bhatnagar *et al*., [33] hardness values less than 20ppm causes stress, 75-150 ppm is optimum for fish culture and >300 ppm is lethal to fish life as it increases pH, resulting in non-availability of nutrients.

Calcium: Calcium is generally present in soil as carbonate and most important environmental, divalent salt in fish culture water. Calcium is an important element associated with different cations like carbonates, bicarbonates and fluorides to exert hardness. The calcium value fluctuated from 140-150mg/l in all ponds. Fish can absorb calcium either from the water or from food.

Wurts and Durborow [10] recommended range for free calcium in culture waters is 25 to 100 mg L-1 (63 to 250 mg L-1 CaCO3 hardness) and according to them Channel catfish can tolerate minimum level of mineral calcium in their feed but may grow slowly under such conditions. Water with free calcium concentrations as low as 10 mg L-1 if pH is above 6.5 can be tolerated by Rainbow trout, 40 to 100 mg L-1 range (100 to 250 mg L-1 as CaCO3 hardness) are desirable for striped bass, red drum or crawfish.

Magnesium: Magnesium content is lower than calcium ions in natural water also follows the same trend in the fish ponds. However, but due to the addition of animal manures and other waste in the water bodies, which increases the values of magnesium i.e., to 46.0-120 mg/l. The present study indicated that these ponds are good for fish culture but not for drinking as the range value is below the permissible limit.

Chloride: Chloride content in fish ponds is important to know the quality of water and sources include fertilizers from surrounding areas and animal wastes. The chloride content in the studied ponds varied from 38.90 to 40.30 mg/L in all ponds, show chloride content is below than the maximum permissible limit prescribed by the WHO [29] standards. In the present study chloride value ranged from 38.90 mg/l to 40.30 mg/l. BIS [30] have set a desirable limit of chloride in drinking water to be 250 mg/l and permissible value has been prescribed to be 1000 mg/l in the absence of any alternative source. Whereas according to WHO (1993), it is 250 mg/l. Chloride is a common component of most waters and is useful to fish in maintaining their osmotic balance**.** According to Stone and Thomford [37] the desirable range of chlorides for commercial catfish production is above 60 mg L-1 and acceptable range is 10 times the nitrite concentration. Chloride (in the form of salt) is required at a minimum concentration of 60 mg L-1 and a ratio of chloride to nitrite of 10:1 reduces nitrite poisoning as catfish are susceptible to "brown blood" disease (caused by excess nitrite in the water). It becomes a matter of concern if chloride levels become high as above 100 mg L-1 in the waters because even in very small concentrations, it burns the edges of the gills with long term after effects and its acceptable range is 0.

Nitrite: During the present study nitrite values were found ranging between 0.2 mg/l to 0.21 mg/l. Nitrite can be termed as an invisible killer of fish because it oxidizes haemoglobin to methemoglobin in the blood, turning the blood and gills brown and hindering respiration also damage for nervous system, liver, spleen and kidneys of the fish. The ideal and normal measurement of nitrite is zero in any aquatic system. Stone and Thomforde [37] suggested that the desirable range 0-1 mg L-1 NO2 and acceptable range less than 4 mg L-1 NO2. According to Bhatnagar *et al*., [33] 0.02-1.0 ppm is lethal to many fish species, >1.0 ppm is lethal for many warm water fishes and <0.02 ppm is acceptable. Santhosh and Singh [21] recommended nitrite concentration in water should not exceed 0.5 mg L-1. OATA [38] recommended that it should not exceed 0.2 mg L-1 in freshwater and 0.125 mg L-1 in seawater.

Alkalinity: BIS [30] has set the desirable limit of alkalinity for drinking water to be 200 mg/l and the permissible value has been prescribed to be 600 mg/l in the absence of any alternative source; however according to WHO [29] it is to be 200 mg/l. In the present study the total alkalinity values ranged from 54-198 mg/l and were found to be well within the standard permissible limit of BIS (1991). If the alkalinity is low, it indicates that even a small amount of acid can cause a large change in our pH.

Water quality is determined by various physico-chemical and biological factors, as they may directly or indirectly affect its quality and consequently its suitability for the distribution [39]. According to Wurts and Durborow [10] alkalinity between 75 to 200 mg L-1, but not less than 20 mg L-1 is ideal in an aquaculture pond. Swann [36] recommended total alkalinity values of at least 20 ppm for catfish production and for good pond productivity. Stone and Thomforde [37] suggested 50-150 mg L-1 (CaCO3) as desirable range; an acceptable range of above 20 mg L-1 and less than 400 mg L-1 for ponds and above 10 mg L-1 for hatchery water. According to Santhosh and Singh (2007) the ideal value for fish culture is 50-300 mg L-1.

Table 1: Mean value of different Physico-chemical parameters of water in each pond and comparison with standard value WHO [29], BIS [30] for water supply.

S. N.	Parameters	Study Area										Standard value	
		P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10	WHO [29] (1993)	BIS [30] (1991)
1	pH	9.0	9.0	11.0	8	9.1	10.0	10.5	10	9.4	9.3	6.5-9.2	6.5-8.5
2	Dissolved Oxygen mg/l	8.6	9.0	10.0	9.0	16.0	9.0	11.0	9.0	8.0	11.0	4-6	04-6
3	BOD mg/l	2.0	6.0	6.2	3.0	5.5	5.0	3.5	4.5	3.8	5.6	6	5
4	COD mg/l	15.0	15.0	14.5	15	14.5	15.5	14.5	14.5	15	15.2	10	-
5	TDS	100	200	350	450	150	100	250	400	450	100	1000	500
6	Total hardness mg/l	200	150	130	135	135	140	160	150	160	148	100-500	300
7	Calcium mg/l	140	150	148	145	140	150	130	140	130	150	200	200
8	Magnesium mg/l	80	48	46	60	100	80	60	80	120	60	150	100
9	Chlorides mg/l	38.0	40	40.0	40.30	60.0	39.2	40.2	50.2	60.2	38.0	250	250
10	Nitrites mg/l	0.21	0.02	0.2	0.02	0.03	0.03	0.21	0.02	0.03	0.04	50	45
11	Alkalinity mg/l	54	198	120	110	80	70	150	160	120	194	200	50-200

Conclusion

Based on the findings it can be concluded that this was not suitable for bathing and drinking but in most of the ponds the production is good and several species inhabit this region. It can be suggested that the use of water recirculation system /closed system/ filtration system.

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References

1. Sahni K, Yadav S. Seasonal Variations in Physico-Chemical Parameters of Bharawas Pond, Rewari, Haryana. Asian Journal of Exerimental Sciences. 2012; 26(1):61-64
2. Brief Industrial Profile Of District BIJNORE, Government of India Ministry of MSME,MSME-Development Institute, Agra (Ministry of Micro, Small & Medium Enterprises, Govt. of India), 3.
3. Stiff Jr HA. The interpretation of chemical water analysis by means of patterns, Journal of Petrol. Technology. 1940; 3:15-16.
4. Wilcox LV. Classification and use of irrigation waters, US Department of Agriculture, Washington DC, 1995, 19.
5. Wilcox LV. The quality water for irrigation use. US Dept. Agric. Bull., 1948, 40.
6. Stumn W, Morgan JJ. An introduction imphasizing chemical equlibria in natural waters, Aquatic chemistry. 2ND Ed., John Wiley and Sons, New York, 1981, 780.
7. Mumtazuddin M, Rahman MS, Mostafa G. Limnological studies of four selected rearing ponds at the aquaculture experiment station, Mymenshingh. Bangladesh Journal of Fisheries Research. 1982; 2-5(1-2):83-90.
8. Meade JW. Allowable ammonia for fish culture, Progressive Fish culture, 1985; 47:135-145.
9. Trifonova IS. Change in community structure and productivity of phytoplankton as indicator of lake reservoir eutrophication, Archiv für Hydrobiologie–Beiheft Ergebnisse der Limnologie, 1989; 33:363-371.
10. Wurts WA, Durborow RM, Interactions of pH, Carbon Dioxide. Alkalinity and Hardness in Fish Ponds Southern Regional Aquaculture Center, SRAC Publication No, 464:1992.
11. Meck N. Pond water chemistry, San Diego, Koi Club, 1996; Http://users.vcnet.com/rrenshaw/h2oquality.html Revised on. 1996.
12. Garg SK, Bhatnagar A. Effect of varying doses of organic and inorganic fertilizers on plankton production and fish biomass in brackish water ponds, Aquaculture Research (The Netherlands). 1996; 27:157-166.
13. Garg SK, Bhatnagar A. Effect of different doses of organic fertilizer (cowdung) on pond productivity and fish biomass in still water ponds. Journal of Applied Ichthyology, 1999; 15:10-18.
14. Naganandini MN, Hosmani SP. Ecology of certain inland waters of Mysore district, occurance of Cyanophycean bloom at Hosakere Lake, Pollut. Res. 1998; 17(2):123-125.
15. Stiassny M. The Medium is the Message: Freshwater Biodiversity in Peril. In the living Planet in Crisis: Biodiversity science and policy. Columbia University Press, New York, 1999.
16. Pandey J, Pandey, Usha, Tyagi HR. Nutrient Status and Cyanobacterial diversity of a tropical fresh water lake. J. Environ. Biol. 2000; 21(2):133-138.
17. Patil DB, Tijare RV. Studies on Water quality of Godchiroli Lake. Poll. Res. 2001; 20:257-259.
18. Garg SK, Jana SN, Bhatnagar A. Effect of inland groundwater salinity on digestibility and other aspects of nutrition physiology in *Mugil cephalus* and *Chanos chanos* (Forsskal), In: Fish production using brackish water in arid ecosystem (eds. Garg, S.K. and Arasu, A.R.T.), Ankush Printers, Hisar, 2003, 53-59.
19. Sikoki FD, Veen JV. Aspects of Water Quality and the Potential for Fish Production of Shiroro Reservoir Nigeria, Living System Sustainable development. 2004;

2:7.
20. Santhosh B, Singh NP. Guidelines for water quality management for fish culture in Tripura, ICAR Research Complex for NEH Region, Tripura Center, Publication 2007, 29.
21. Sadashivaiah C, Ramakrishnaiah CR, Ranganna G. Hydrochemical Analysis and Evaluation of Groundwater Quality in Tumkur Taluk, Karnataka State,India, International Journal of Environmental Research Public Health. 2008; 5(3):158-164.
22. Bhatnagar A. Productivity and fish biodiversity of selected ponds of Haryana, Project Report submitted to Department of fisheries Government of Haryana, 2008.
23. Kiran BR. Physico-chemical characteristics of fish ponds of Bhadra project at Karnataka, RASĀYAN Journal of Chemistry, 2010; 3(4):671-676.
24. Dhasarathan P, Palaniappan R, Ranjit Singh AJA. Effect of endosulfan and butachlor on the digestive enzyme and proximate composition of the fish, cyprinus carpio Indian J. Environ. And Ecoplan. 2000; 3(3):611-614.
25. Stiassny M. An overview of fresh water biodiversity: with some lessons from African fishes. Fisheries. 1996; 21:7-13.
26. Maponline, 2016. http/www.mapsofindia.com 1August
27. APHA, Standard methods for the examination of water and waste water. 20th Ed., American public health Association, Washington, 1998.
28. WHO. World Health Organization. Guidelines for Drinking Water Quality, World Health Organization, Geneva, Switzerland, 1993.
29. BIS, Indian standard specification for drinking water. IS: 10500, Indian Standard Institute, 1991.
30. Bhatnagar A, Garg SK. Causative factors of fish mortality in still water fish ponds under sub-tropical conditions, Aquaculture. 2000; 1(2):91-96.
31. Solis NB. The Biology and Culture of *Penaeus Monodon*, Department Papers. SEAFDEC Aquaculture Department, Tigbouan, Boilo Philippines, 1988, 3-36.
32. Bhatnagar A, Jana SN, Garg SK, Patra BC, Singh G, Barman UK. Water quality management in aquaculture, In: Course Manual of summer school on development of sustainable aquaculture technology in fresh and saline waters, CCS Haryana Agricultural, Hisar (India), 2004, 203-210.
33. Bhatnagar A, Singh G. Culture fisheries in village ponds: a multi-location study in Haryana, India. Agriculture and Biology Journal of North America. 2010; 1(5):961-968.
34. Ekubo AA, Abowei JFN. Review of some water quality management principles in culture fisheries, Research Journal of Applied Sciences, Engineering and Technology. 2011; 3(2):1342-1357.
35. Swann LD. A Fish Farmer's Guide to Understanding Water Quality, Aquaculture Extension Illinois, Purdue University, Indiana Sea Grant Program Fact Sheet AS-1997, 503,
36. Stone NM, Thomforde HK. Understanding Your Fish Pond Water Analysis Report. Cooperative Extension Program, University of Arkansas at Pine Bluff Aquaculture / Fisheries, 2004.
37. Ornamental Aquatic Trade Association (OATA). Water Quality Criteria-ornamental fish. Company Limited by Guarantee and Registered in England No 2738119 Registered Office Wessex House, 40 Station Road, Westbury, Wiltshire, BA13 3JN, UK, 2008;info@ornamentalfish.org www.ornamentalfish.org. Version 2.0 March 2008.
38. Rana N, Varma M, Jain S. Assessment Of Different Water Quality Parameters Of Water Sources Of Meerut Region (Uttar Pradesh, India) For Suitability Of Fish Production. Journal of Environmental Bio- Scicences., 2016; 30(2):0973-6913 (Print), ISSN 0976-3384 (On Line).