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Bacteriological studies of pond water in and around Patna

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Abstract: This study aims at addressing necessity and concept of Water Quality Monitoring (WQM), different methodology of WQM and to apply the complete WQM process for assessing water quality status of different pond water in Patna . The objective of our work is to study the bacteriological condition of pond water at different sites of Patna for recreation. Pond water samples of both natural and manmade have been taken and parameters like, D.O., B.O.D, Temperature, TC, FC , etc. have been further compared with Primary water criteria for surface water for different uses **(1)** . Results in general indicated that in some ponds, water quality was found to be deteriorated.

Key words: Pond water quality Monitoring , Bacteriological study, recreation, objective.

INTRODUCTION

Ponds are considered to be one of the most productive and biologically rich inland surface water ecosystem. It represents a complete self – maintaining and self- regulating ecosystem. Ponds are either natural or man-made. A pond is a small area of still, fresh water and its water has been used for livestock bathing, swimming, irrigation, and fish production generally, dumping of rubbish, chemical pollution from farming fields, waste water disposal from drains etc. which meet into the pond water resulting into contamination[2].

Dumping of rubbish- anything from old cars and cans to bikes and bottles have been found cluttering up ponds. Such thoughtless behaviour not only makes the environment look so unsighty but it may also destroy pond- life. Perhaps the most serious threat to ponds is chemical pollution as a result of modern farming methods. Over the years, fields have been sprayed with pesticides

to rid the crops of pests. However, rain often washes the excess chemicals off the crops into nearby ponds, poisoning the pond water for animals living there. Another, equally serious problem connected with agriculture is the use of artificial fertilizers. Powdery chemical fertilizers, containing nitrates, are put on the crops to help their growth but they can also be washed off by rain into nearby ponds. The rich supply of nitrogen causes quick growth of algae which is called eutrophication[3].

Ponds are currently degraded by both natural and anthropogenic activities, which deteriorate their water quality and push them to the brink of extinction in the process of unplanned development or urbanization worldover including Patna. Pond water can be a source of water for drinking purposes after treatment and with proper and regular water quality monitoring process[4].

For the purpose of this study, the use of water for recreation was treated as the primary consideration. This is not to imply that recreation is the most important use of water, but rather, that people are most likely to judge the water quality by whether a water body is fit for fishing or swimming . The population may also be aware that the

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water quality requirements for navigation and cooling are less severe than for recreation .

MATERIALS AND METHODS

Patna district of Bihar is the study area of our research work. Both natural as well as man-made ponds have been selected for all the three seasons; Summer , winter and post monsoon over a year 2009-10. The samples are collected with the help of a clean plastic container, rinsed several times with the help of same samples which are to be analysed. However Before sampling of water, all the sampling bottles of 250mL. were sterilized by autoclaving at 120oC and 102 + 0.3 kg/cm3 gauge pressure by using a piece of brown paper inside and outside the mouth and wrapped around the mouth over the stopper by thread. Sometimes chlorination has been done by the supply agency ,therefore dechlorination was done by using 0.5ml N/40 Sodium thiosulphate (Na2S2O3) to provide a suitable condition for bacterial growth. Now sterilized bottle was opened and water collected carefully below the neck . After filling the stopper was tightly fixed with brown paper and wrapped with thread around the mouth . The sample bottle was labeled with date time and the relevant details with water proof ink **(5)** . Pond water of eight selected sites were taken under study and these are kacchi talab (S1), S2 (Secretariate pond), S3 (Pond of Botanical garden), S4 (BMP-5 Pond), S5 (Mangal talab), S6 (Abhiyanta bhawan pond), S7 (Fishery pond behind museum), S8 (Fishery pond agamkuan tank no-3) etc. . All samples were collected from july 2009 to june 2010.

The pH was determined using electrical digital pH meter , turbidity with nephelometer and the estimation of hardness, D.O., B.O.D, FC, TDS, Chloride, Phosphate, Nitrate, Fluoride were carried out by standard methods . But the main focus in our study is to calculation and determination of bacteriological parameters like, D.O., B.O.D, FC, and TC. **(6).**

As samples are the representative of the water to be tested hence these were collected with utmost care to ensure that no contamination occurred at the time of collection. For this examination, grab sample was made manually.

The coliform group includes the entire aerobic and facultative anaerobic gram negative spore forming rod shaped bacteria which ferment lactose with gas formation within 48hrs at 370C. The standard test for the estimation of number of the coliform groups was carried out by multiple tube dilution technique. The number of positive findings of coliform group or streptococcus group organism (either presumptive or confirmed) resulting from the multiple portion decimal dilution planting was computed as combination of the positive and recorded in terms of the Most Probable Number. It is represented as MPN/ 100Ml **(7).**

RESULTS AND DISCUSSION

The objective of our work is to study the bacteriological condition of pond water at different sites of Patna for recreation. The assessment of different levels of bacteriological parameters, during the period of our work, shows considerable disagreement with the standard guideline for surface water qualities by WHO, ISI and other agencies.

The data regarding the condition of water in different localities of Patna has been enumerated in tabular form. These data are the result of the experiment carried out in the laboratory. This study has been conducted in the year 2009-2010 in three seasons. At first the samples of all the eight ponds of the year 2009-10 of three seasons has been analysed, observed, calculated and enlisted here.

Pond water at almost all the sites was found to be contaminated, except a few sites, where it was found moderately contaminated during this period 2009-2010. In general, to some extent water quality showed deterioration after the onset of monsoon. It was found that some effective measures are urgently required for water quality management in this region.

CONCLUSION

As stated in our objective S3(Pond of Botanical garden), S4(BMP-5Pond), S5(Mangal talab) are to be developed for recreation and the criteria for recreation is

As stated in our objective S1 (Kacchi talab), S2(Secretariate pond), S6(Abhiyanta bhawan pond), S7 (Fishery pond behind museum), S8 (Fishery pond agamkuan tank no-3) is to be developed for fishing and the criteria for fishing is

From the above result it is evident that the values of

Table 1: S1 (kacchi talab)

Parameters	First Sampling	Second Sampling	Third Sampling	Average
Temp0C(A/W)	30/29	30/26	24/20	28/25
D.O.(mg/L)	1.1	3.8	1.5	2.133
BOD(mg/L)	7	6	5	6
TC	>240000	15000	110000	121666.7
FC	>110000	9300	4300	41200
pH	7.85	7.75	7.50	7.70

Table 2: S2 (Secretariate pond)

Parameters	First Sampling	Second Sampling	Third Sampling	Average
Temp0C(A/W)	35/27	28/25	24/20	29/24
D.O.(mg/L)	7.6	6	10.5	8.03
BOD(mg/L)	5.8	1.6	2.3	3.23
TC	46000	24000	9300	26433.33
FC	24000	4300	4300	10866.67
pH	8.91	8	8.21	8.37

Table 3: S3(Pond of Botanical garden)

Parameters	First Sampling	Second Sampling	Third Sampling	Average
Temp0C(A/W)	30/28	28/25	21/20	26.3/24.3
D.O.(mg/L)	3.3	2.8	6	4.03
BOD(mg/L)	6.2	6.9	3.8	5.6
TC	4300	9300	46000	19867
FC	2300	4300	24000	10200
pH	8.04	7.95	7.53	7.84

Table 4: S4 (BMP-5 Pond)

Parameters	First Sampling	Second Sampling	Third Sampling	Average
Temp0C(A/W)	31/29	31/26	22/20	28/25
D.O.(mg/L)	2.9	2.6	7.9	4.466
BOD(mg/L)	6.8	7.1	2.9	5.6
TC	9300	4300	46000	19866
FC	4300	2300	15000	7200
pH	8.33	8.02	7.66	8.00

Table 5 :S5 (Mangal talab)

Parameters	First Sampling	Second Sampling	Third Sampling	Average
Temp0C(A/W)	31/29	28/22	20/18	26.3/23
D.O.(mg/L)	1.2	2.1	7.2	3.5
BOD(mg/L)	6.8	6.0	2.9	5.23
TC	15000	46000	110000	57000
FC	9300	24000	46000	26433
pH	8.24	7.36	7.48	7.693

Table 6: S6 (Abhiyanta bhawan pond)

Parameters	First Sampling	Second Sampling	Third Sampling	Average
Temp0C(A/W)	35/27	32/25	22/20	29.6/24
D.O.(mg/L)	7.6	8.1	4.6	6.766
BOD(mg/L)	5.8	3.6	4.4	4.6
TC	46000	>240000	>240000	1753333.3
FC	24000	110000	15000	49666.67
pH	8.73	8.04	8.06	8.27

Table 7: S7 (Fishery pond behind museum)

Parameters	First Sampling	Second Sampling	Third Sampling	Average
Temp0C(A/W)	35/28	35/25	20/18	30/23.6
D.O.(mg/L)	5	5.8	10.4	7.06
BOD(mg/L)	3.1	2.8	4	3.3
TC	7500	9300	15000	10600
FC	4300	4300	4300	4300
pH	8.84	7.76	8.14	8.25

Table 8: S8 (Fishery pond agamkuan tank no-3)

Parameters	First Sampling	Second Sampling	Third Sampling	Average
Temp0C(A/W)	31/28	26/25	20/18	25.6/23.6
D.O.(mg/L)	2.4	3	0.7	2.03
BOD(mg/L)	7.1	6.8	9.5	7.8
TC	15000	15000	>240000	90000
FC	4300	1500	110000	38600
pH	7.86	7.41	7.26	7.51

Desired	Observed		
	S3	S4	S5
1. Total coliforms organism MPN/100Ml shall be 500 or less 2. Ph between 6.5 and 8.5 3. Dissolved Oxygen 5 mg/L or more 4. Biochemical Oxygen Demand 5 days at 20 0c 3mg/L or less	1. 19867 MPN/100Ml 2. 7.84 3. 4.03 4. 5.6 mg/L	1. 19867 MPN/100Ml 2. 8 3. 4.66 mg/L 4. 5.6 mg/L	1. 57000 MPN/100Ml 2. 7.7 3. 3.5 mg/L 4. 5.23 mg/L

Desired	observed				
	S1	S2	S6	S7	S8
1. Ph between 6.5 to 8.5	1. 7.7	1. 8.37	1. 8.27	1. 8.25	1. 7.51
2. D.O 4 mg/L or more	2. 2.13	2. 8.03	2. 6.7	2. 7.06	2. 2.03
3. Free Ammonia (as N) 1.2 mg/L or less	3. 0.414	3. 0.252	3. 0.037	3. 1.479	3. 1.479

different parameters are not satisfying the set guidelines. So proper steps should be taken by the state authorities, so that these ponds could be used for the desired purposes.

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