Indian J.Sci.Res. 13 (2): 172-177, 2017 ISSN: 0976-2876 (Print)
ISSN: 2250-0138 (Online)

PHYSIOCHEMICAL AND MICROBIAL STUDY OF WATER QUALITY OF NON-RESERVED PONDS OF BHILAI- DURG

AKANKSHA CHAUHAN[a], SABIHA NAZ[b1] AND BHAWANA PANDEY[c]

[a]VYPTG College, Durg, Chhattisgarh, India
[bc]Department of Biotechnology & Microbiology, Bhilai Mahila Mahavidyalaya, Hospital Sector, Bhilai, Chhattisgarh, India

ABSTRACT

Water plays an important role in the development of healthy society. Water pollution occurs due to pollutant, which degrade the water quality of ponds, enter the waterway and alter their natural function. The increased demand for water as a consequence of population growth, agriculture and industrial development has usurped environmentalists to determine the chemical, physical and biological characteristics of natural water resources. In present investigation the physicochemical (taste, odor, color, pH, temperature, alkalinity, total dissolved solids, chemical oxygen demand, biological oxygen demand, total hardness) and microbial parameters of collected samples from Kham Pond, Shitla Pond and Koosta non-reserved ponds were done. Results of physiochemical parameters were compared with limits prescribed by WHO standard (1984) and analyzed higher than the give standard value of the WHO for drinking and human uses. Studies of microbial flora (bacterial and fungal) of non-reserved ponds were observed NR1-three, two NR2-two, four and NR3-two, four colonies. The Morphological and Biochemical characteristics for identification of the isolates were done. The isolated bacterial and fungal species were identified with reference to Bergey's Manual of Determinative Bacteriology and book for Fungal Identification. These identified bacterial and fungal isolates include *Staphylococcus* sp., *Streptococcus* sp., *Micrococcus* sp., *Pseudomonas* sp., *Aspergillus niger, Aspergillus fumigates, Aspergillus flavus,* and *Fusarium sp.* Present investigation concluded that the maximum parameters were exceeding the level of pollution except few parameters. All three ponds water not satisfied the requirement for the domestic use. The study of non-resrved pond water indicated that the community ponds are highly polluted and unsafe for human use.

KEYWORDS: Physicochemical, Morphological characteristics, Total dissolved solids, Chemical oxygen demand and Biological oxygen demand

Water is the most abundant and most useful compound in the world and hence it is called 'Jeevan' in Sanskrit. Life is not possible without water. 70% surface of earth is covered by water, Majority of water available on the earth is saline in the nature only 3 % of exists as fresh water. Fresh water has become a scare commodity due to over exploitation and pollution (Patil and Tijare 2001; Singh and Mathur, 2005). Water bodies get polluted due to the discharge of effluents from the industries, domestic waste, land and agricultural drainage and degrade water quality (Gupta and Shukla 2006).

The effect of increasing industrialization and population led to increase in living standard, ultimately which results decrease in the quality of water. Many of the water bodies are not suitable for domestic and other purposes, so that possible remedial measures should be adopted for these water resources (Mahima *et al*.,2007). A good knowledge of the physicochemical and microbial qualities of raw water is necessary so as to guide its suitability for use. Thus, regular physico-chemical analysis of water at source must be carried out to determine or check the effectiveness of treatment process (Okonko *et al.,* 2008).

Physico-chemical characteristics of water of the pond was studied at Village Lohara, (Yavatmal) during March 2006 to February 2007 at three sampling and result shown that parameters like total hardness, chloride, sulphate, Zn were found in excessive amounts (Bhagat, 2008). The pollution level in the river of Tamiraparni were studied and found that the existence of coliform bacteria in river water was highest in December post monsoon, while it was least in May-i.e. Pre monsoon (Hema and Muthalagi, 2009). Water quality of Kolura pond were analysed in post monsoon season and found that all parameters were within permissible limit as prescribed by WHO, ICMR and BIS standard and concluded that water is non polluted and suitable for fisheries drinking and irrigation purposed (Pagariya, 2012).

Physico- Chemical qualities of water samples from six major ponds situated in Rajnandgaon district of Chhattisgarh have been evaluated on seasonal basis from January to December 2012 and result obtained out of these six ponds Lakholi talab is most polluted. The nitrate content of sample 3 is above prescribed limit of BIS. All these six water bodies are not suitable for domestic and drinking purposes, proper treatment is necessary before their use for drinking purpose (Mohabe *et al*., 2013). Prediction of water quality of non reserved pond of Bhilai-Durg region were done and result of physicochemical investigation shown that of

[1]Corresponding author

non-reserved ponds water were found that the maximum parameters were exceeded at the level of pollution except few parameters and *Staphylococcus aureus, Salmonella species, E. coli, Pseudomonas aeruginosa, Bacillus species, Proteus species,* and *Klebsiella species* microbial isolates were identified. Non reserved pond water were highly polluted and unsafe for human uses (Naz, 2014). Physico-chemical parameters of different pond water of Bilaspur district result obtained that proposed study will establish some facts about the use of water for various purposes like domestic and agriculture (Pandey *et. al.,* 2015).

The present investigation attempts to analyze physico- chemical parameters and microbial flora of non-reserved ponds of Bhilai-Durg region.

MATERIALS AND METHODS

In present studies physiochemical and microbial analysis of Kham Pond, Shitla Pond and Koosta non-reserved ponds were done.

Physico - Chemical Analysis of Ponds Water Samples

Physiochemical studies (Odor, Test, Temperature, pH, Total Alkalinity, Total Hardness, Total Dissolve Solid, Chemical Oxygen Demand, Biological Oxygen Demand, Dissolve Oxygen) were done for collected pond samples according to APHA standard methods (1998).

Study of Microbial Flora of Non Reserved Ponds

Isolation of microorganisms was done by serial dilution method using water sample of Kham Pond, Shitla Pond and Koosta non-reserved pond**.** The pure cultures of the bacterial and fungal) isolates were subjected to various morphological study, differential staining (Gram's and endospore) (Lactophenol cotton blue) and biochemical characterization tests (catalase test, starch hydrolysis, indole, MR-VP, simmon's citrate agar, fermentation, H_2S production, nitrate reduction, urease, casien hydrolysis, gelatin hydrolysis) to determine the identity of the bacterial and fungal isolates with reference to Bergey's Manual of Determinative Bacteriology and Fungal Identification Book, (Buchanan, and Gibbons, 1974; Nagamoni, and coworkers 2006).

RESULTS AND DISCUSSION

In present study the physicochemical and microbial parameters of non-reserved ponds water samples were done and the results were compared with limits prescribed by WHO standard (1984). The taste, odor, color, pH, temperature, alkalinity, total dissolved solids, chemical oxygen demand, biological oxygen demand, total hardness of the non-reserved ponds water samples were analyzed higher than the give standard value of the WHO whereas and total hardness for NR1 pond were under range of standard value of WHO shown in Table-1.

Table 1: Shown Physiochemical analysis of Non-reserved ponds with respect to Std. Value given by WHO

S. No.	Physiochemical Test	Non reserved pond water			Standard Value given by WHO
		NR1	NR2	NR3	
1.	Total Dissolved Solid (TDS)	700	1000	1500	500
2.	Biological oxygen Demand (BOD)	59.4	71.3	86.26	6.0
3.	Chemical oxygen Demand (COD)	745	787	837	255
4.	Dissolved oxygen (DO)	3.1	2.4	2.2	5.0
5.	Total Alkalinity	380	158	380	100
6.	Total Hardness	424	519	576	500
7.	Temperature (ºC)	31.0	33.0	30.0	30
8.	Ph	7.4	8.1	7.9	6.5-8.5
9.	Color	Leaf green	Colorless	Light green	--
10.	Odor	Pungent	Odorless	Pungent	Agreeable
11.	Taste	Tasteless	Tasteless	Tasteless	--

Where, **NR1**- Kham Pond, **NR2**- Shitla Pond and **NR3**- Koosta Pond

Table 2: No. of Colonies Isolated From Different Sample Sites

Sample site	NR1	NR2	NR3
No. of Colonies	3 B1,B2,B3	2 C1,C2	2 D1,D2

Table 3: Morphological and Microscopic characteristics of bacterial species

Isolate	Morphological characteristics	Microscopic characteristics	Organism
B1, C1, D1	Circular, low convex with entire margin smooth white colony, convert mannitol salt agar in yellow colour.	Gram positive, cocci, arranged in grape like, cluster.	*Staphylococcus sp.*
C2	Circular, entire, opaque, thin white colony on NAM media.	Gram positive, cocci, arranged in chains or pairs.	*Staptococcus sp.*
B2	Circular, irregular, transparent, filiform, translucent and no pigmentation colony.	Gram positive, small cocci, in clusters and tetrads.	*Micrococcus sp.*
B3, D2	Spherical, abundant, thin colorless colony on NAM media.	Gram negative, short rod, cluster.	*Pseudomonas sp.*

Table 4: Biochemical test for identification of isolated bacteria from ponds sample

S.No	Biochemical test	NR1			NR2		NR3	
		B1	B2	B3	C1	C2	D1	D2
1.	Motility test	-	-	+	-	-	-	+
2.	Catalase test	+	+	-	+	-	+	-
3.	Glucose fermentation test	A	A	A	A	A	A	A
4.	lactose fermentation test	-	-	-	-	-	-	-
5.	Sucrose fermentation test	-	-	-	-	-	-	-
6.	Amylase test	-	-	-	-	-	-	-
7.	Indole test	-	-	-	-	-	-	-
8.	MR test	+	+	-	+	+	+	-
9.	VP test	-	-	-	-	-	-	-
10.	Citrate test	-	-	+	-	-	-	+
11.	Urease test	+	+	-	+	+	+	-
12.	Gelatin test	+	+	+	+	-	+	+
13.	H_2S test	-	-	-	-	-	-	-

Note :- (+) = Positive, (-) = Negative, A = Acid,

Table 5: No. of fungal colonies isolated from different sample sites

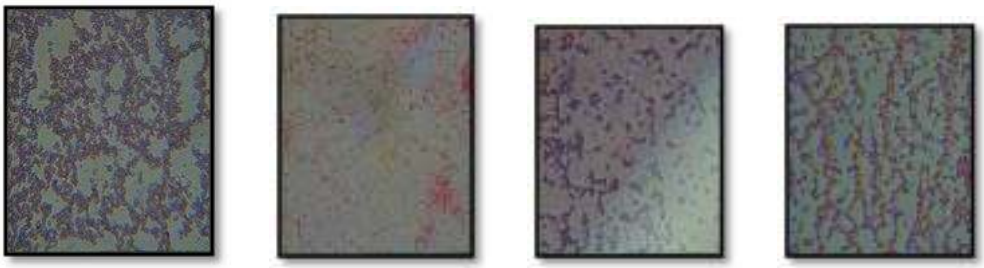
Sample site	NR1	NR2	NR3
No. of Colonies	**2 A1,A2**	**4 E1,E2,E3,E4**	**4 G1,G2,G3,G4**

Table 6: Morphological and Microscopic characteristics of fungal species

Isolate	Morphological characteristics	Microscopic characteristics	Organism
E3,G3	Fast Growing colonies, white yellow-brown, brown to black or shades of green colony	Mycelium septate, branched hyphae colourless, conidial apparatus developed as stalk and head, producing conidiophores at long axis, septate or unseptate.	*Aspergillus niger*
E1,G1	Granular colonies, yellow or yellow brown in colour, fluffy appearance.	Conidiophores were hyaline with conidial heads, velvety or wooly colonies, non septate or partially septate hyphae.	*Aspergillus flaves*
A1,E2,G2	Smoky blue green surface pigmentation with suede like surface consisting of dance felt of conidiophores, smooth wooly colony.	Typical columnar, uniseriate conidial heads, commonly conidia produced in long chain.	*Aspergillus fumigates*
A2,E4,G4	Light yellow- surface pigmentation, red with cottony.	Moist appearance, orange brown mycelium, with light brown exudates hyphae septate.	*Fusarium sp.*

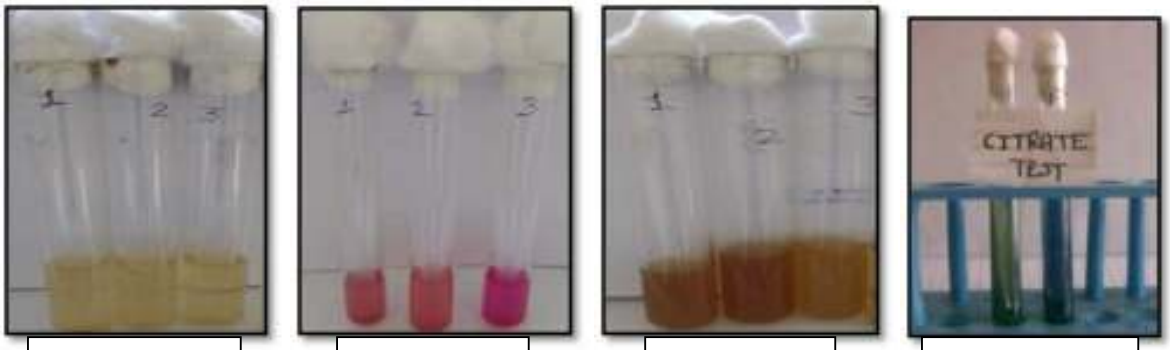
NR1- Kham pond **NR2- Shitla pond** **NR3- Koosta pond**

Figure 1: Isolated bacterial colonies from Non-reserved Ponds water samples



Staphylococcus species ***Micrococcus species*** ***Straptococcus species*** ***Pseudomonas species***

Figure 2: Gram staining test for identification of bacterial colonies isolated from Non-reserved Ponds

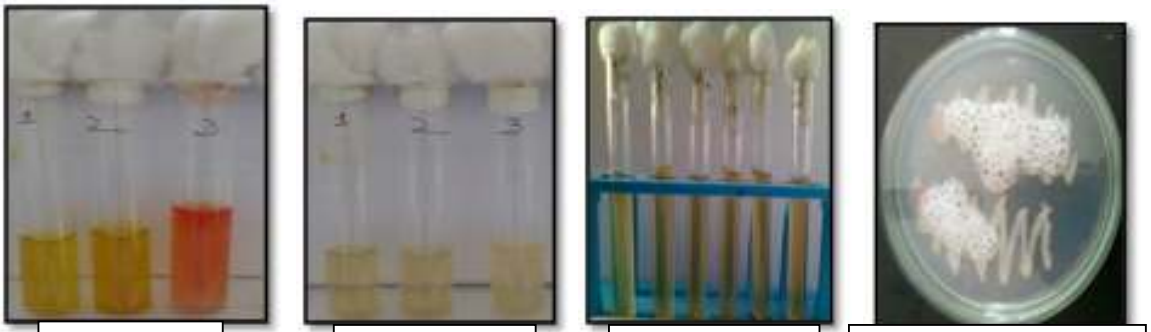


Gelatin test (+ve) for all strains

Urease test (+ve) for all strains accept B_3, D2

Indole test (-ve) for all strains

Citrate test (+ve) for B3, D2 & (-ve) for B1, B2, C1, C2, D1



MR test (+ve) for all strains accept B2, D2

VP test (-ve) for all strains

H_2S test (-ve) for all strains

Catalase test (+ve) for B_1, B2, C1, D1 & (-ve) for B_3, C2, D2

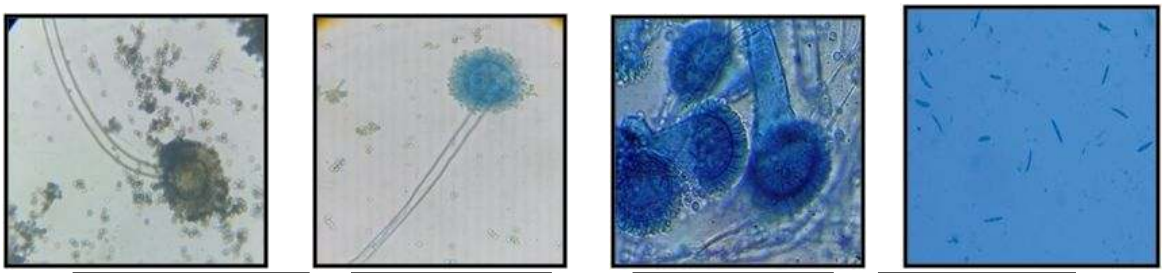
Figure 3: Biochemical test for identification of bacterial colonies isolated from Non-reserved Ponds water samples

NR1- Kham pond **NR2- Shitla pond** **NR3- Koosta pond**

Figure 4: Isolated fungal colonies from Non-reserved Ponds water samples

[A] **[B]** **[C]** **[D]**

Figure 5: Pure culture of isolated fungal colonies from Non-reserved Ponds water samples.



Aspergillus niger ***Aspergillus flaves*** ***Aspergillus fumigatus*** ***Fusarium* sp.**

Figure 6: Lacto phenol cotton blue staining test for identification of fungal colonies isolated from Non-reserved

Studies of microbial flora (bacterial and fungal) of non-reserved ponds were observed NR1-3, 2 NR2-2, 4 and NR3-2, 4 colonies (Table-2 and 5). The Morphological and Biochemical characteristics of the isolates obtained from these water samples were done. The isolated bacterial and fungal species were identified with reference to Bergey's Manual of Determinative Bacteriology and Fungal Identification. These identified bacterial and fungal isolates include *Staphylococcus sp*., *Streptococcus* sp., *Micrococcus* sp., *Pseudomonas* sp., *Aspergillus niger, Aspergillus fumigates, Aspergillus flavus, Fusarium* sp. (Table-3,4 and 6).

Previous results show that Physico-chemical qualities of water samples from six major ponds situated in Rajnandgaon district of Chhattisgarh are not suitable for domestic and drinking purposes, proper treatment is necessary before their use for drinking purpose (Mohabe *et al*., 2013). Prediction of water quality of non reserved pond of Bhilai-Durg region were done and result of physicochemical investigation show that of non-reserved ponds water were found that the maximum parameters were exceeded at the level of pollution except few parameters and *Staphylococcus aureus, Salmonella species, E. coli, Pseudomonas aeruginosa, Bacillus species, Proteus species,* and *Klebsiella species* microbial isolates were identified. Non reserved pond water was highly polluted and unsafe for human uses (Naz, 2014). Physico-chemical parameters of different pond water of Bilaspur district result obtained that proposed study will establish some facts about the use of water for various purposes like domestic and agriculture (Pandey *et. al.,* 2015). Previous studies supported to the present studies (Figure 1 to 6).

CONCLUSION

In present work, study of physiochemical and microbial parameter of non-reserved ponds was done. In this present investigation it was found that the maximum parameters exceed the level of pollution except few parameters. So all three ponds water do not satisfy the requirement for domestic and other uses. But the study of non-reserved pond water indicated that the community ponds are highly polluted and unsafe for human use. Among the various means of pollutions of water bodies, the main causes of the pollution of pond were washing of the clothes, cleaning of animals, dumping of the waste by unauthorized small scale units functioning in the surrounding to this pond. Bacteria and fungus present in ponds water is helpful for biodegrading of degradable materials but some harmful microbes were seen. The pathogenic organisms and the indicator organisms present in all the water samples render them unfit for human and animal consumption. Water quality should be controlled in order to minimize acute problem of water related diseases, which are endemic to the health of animal and human. Thus, regular physico-chemical and microbial analysis of water at source must be carried out to determine or check the effectiveness of treatment process.

ACKNOWLEDGEMENT

I am highly grateful for the opportunity permitted by the head of the institute of Bhilai Mahila Mahavidyalaya, Bhilai for carrying out my work here. It is a pride for me to express my gratitude to my Honorable Principal Dr. Zehra Hasan Madam.

REFERENCES

APHA, 1998. Standard method for the examination of water and waste water, (19th Bacterioloy. 8th eds. pp290-340.(1974). Williams & Wilkins, Baltimore, Maryland.

Bhagat P.R., 2008. Study of Physico-Chemical Characteristics of the Accumulated Water of Pond of Lohara, At Yavatmal (M.S.). Journal of Chemistry, **1**(1):195-197.

Buchanan R.E. and Gibbons N.E. (Eds) 'Bergey's Manual of Determinative (Ed.). New York: *American Public Health Association*, Inc.

Gupta S. and Shukla D.N., 2006. Physicochemical analysis of sewage water and its effect on seed germination and seedling growth of *Sesamum indicum*. J. Nat. Res. Development, **1**:15-19.

Hema S. and Muthalagi S., 2009. Mass balance approach for assessment of pollution load in the Tamiraparani river. Int. J. Chem. Tech. Res., **1**(2):385-389.

Mohobe H., 2013. Study of Physico-Chemical Characteristics of Water Ponds of Rajnandgaon Town, Chhattisgarh. International J. of Scientific & Engineering Research, **4**(8):738-748.

Naz S., 2014. Study for prediction of water quality of Non- Reserved Ponds of Bhilai- Durg Regions for Various Purpose. International Interdisciplinary Research Journal, **4**:276-284.

Okonko Iheanyi Omezuruike1, Adejoye Oluseyi Damilola, Ogunnusi Tolulope Adeola, Fajobi, Enobong A. and Shittu Olufunke B., 2008. Microbiological and physicochemical analysis of different water samples used for domestic purposes in Abeokuta and Ojota, Lagos State, Nigeria. African Journal of Biotechnology, **7**(5):617-621.

Pagariya S.K., 2012. Analysis of Water Quality using Physico-Chemical Parameters of Kolura Pond in post monsoon. I.J.C.P.S., **1**(2):48-53.

Pandey S.K., Mehta R. and Dixit A.K., 2015. Study of Physicochemical Parameters of Different Pond water of Bilaspur District C.G. India. Environmental skeptics and critics, **4**(3):89-95.

Patil D.B. and Tijare R.V., 2001. Studies on Water Quality of God Chiroli Lake. Pollution Research, **20**:257-259.

Singh R.P. and Mathur P., 2005. Investigation of physiochenmical characteristics of fresh water reservoir of Ajmer city Rajsthan. Ind. J. Env. Sci., **9**:57-61.

W.H.O., 1984. WHO Guidelines for Drinking Water, Geneva, Switzerland. 1: