*International Research Journal of Environmental Sciences*_____ ISSN 2319–1414
Vol. **7(2),** 49-53, February **(2018)** *Int. Res. J. Environmental Sci.*

Short Communication

Characterization of drinking water quality of Pilloor dam, Coimbatore district, Tamil Nadu, India

Siva Dharshini R., Poonkothai M.* and Santhy K.S.
Department of Zoology, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu, India
poonkothaiadu@gmail.com

Available online at: www.isca.in, www.isca.me
Received 1st December 2017, revised 13th February 2018, accepted 20th February 2018

Abstract

The present study explores the characterization of physicochemical parameters of surface water of different stations of Pilloor dam, Coimbatore, Tamil Nadu, India. The water samples collected from different stations were performed for analysis of various parameters such as colour, odour, pH, turbidity, electrical conductivity, alkalinity, salinity, total hardness, total solids, total suspended solids, total dissolved solids, dissolved oxygen, BOD, COD, chloride, sulphate, fluoride, nitrate, iron, nickel and chromium as per the standard methods recommended by APHA. The coliform counts present in the drinking water samples were performed using Most Probable Number (MPN) technique and the numbers of bacterial and fungal colonies were enumerated by standard plate count method. The results of the present study revealed that the physicochemical parameters and MPN limits were within the permissible limit prescribed by BIS. Thus the results indicates that the water sample of Pilloor dam is safe for drinking and does not cause any hazardous effect to the human life and the environment.

Keywords: Surface water, physico-chemical and microbiological parameters, Pilloor dam.

Introduction

In the ecosystem, water is considered to be the second environmental factor for living beings after oxygen[1].

India is bestowed with a network of rivers and covered with snow in the Himalayan range which can meet various water requirement of the country[2]. Indian rivers seem to be the reservoir of water resources and play a significant role in numerous activities such as irrigation, drinking, fish culture and power generation. Due to the exploitations of fresh water resources, many hydrological studies were recognized to manage them. Scientist of All Indiaa Institute of Medical Sciences, New Delhi has reported that many disease causing microbes were found to be prevalent in drinking and recreational water. Reports by scientists and researchers revealed that rapid industrialization and human activities have polluted the Indian river system. Hence it is significant to study the physical, chemical and microbial characteristics of water, a potent environmental factor for the living beings[3-5].

Changes in the environmental factors, discharge of biological and chemical pollutants from various resources alters the quality of surface water. Increased amount of nutrients in the water leads to eutrophication and massive algal growth, which in turn raises the turbidity, suspended solids and BOD of the surface water resources[6]. Coliforms seem to be the indicator for the various infectious diseases from water. Intake of water high in coliforms may lead to diarrhea and fever among children and adults.

Pilloor is a hill station area which constitutes many dyeing and bleaching units situated in the upstream. Till date, many industrial units let the untreated effluents illegally into the aquatic bodies. It may cause serious impact on agriculture, livestock, fisheries and various health problems such as skin allergies and lung infections. With this background a study has been undergone to assess the physicochemical and microbiological parameters of the water samples collected from different stations of Pilloor dam, a reservoir of water resource situated in Coimbatore district.

Materials and methods

Sample collection: The water samples were collected from five different stations namely Pilloor, Athikadavu, Nellithurai, Mettupalayam and Bhavanisagar, during the month of September 2015 for the estimation of different environmental variables. The water samples were collected from different stations to analyse the physicochemical and microbial characteristics in precleaned and rinsed polythene water can of five litre capacity. The samples were protected from sunlight and immediately brought to the laboratory for examination.

Physicochemical characterisation of water samples: The water samples collected from different stations were analysed for its physicochemical parameters namely colour, odour, pH, turbidity, electrical conductivity, alkalinity, salinity, total hardness (TH), total solids (TS), total suspended solids (TSS), total dissolved solids (TDS), dissolved oxygen (DO), Biological

Oxygen Demand (BOD), Chemical Oxygen Demand (COD), chloride, sulphate, fluoride, nitrate, iron, nickel and chromium in the laboratory by adopting the standard procedures[8].

Enumeration of bacteria and fungi in the water samples: The water samples were collected aseptically from different stations and serially dilute (10^{-1} to 10^{-8} dilution) to isolate the bacterial and fungal colonies. From each dilution 1ml of the water sample was spread plated on to sterile nutrient agar (bacteria) and rose bengal chloramphenicol agar (fungi) medium separately. The plates were incubated at 37^0C for 24 hours for bacteria and at room temperature for 5 days for fungi separately. After incubation period, the number of bacterial and fungal colonies was counted and the colony forming units (CFU) per ml of the water sample was expressed as

$$\text{Number of microbial colonies} = \frac{\text{No. of colonies (Average of three replicates)}}{\text{Volume of sample plated X Dilution factor}}$$

Analysis of total coliforms in the water samples: Total coliforms present in the selected water samples were identified using Most Probable Number (MPN) technique. Fermentation tubes containing sterile lactose bile broth was inoculated with measured volumes of water samples and incubated at 37^0C for 24 hours. The coliform bacteria present in the water sample was detected by the formation of acid and gas. From the number of tubes showing positive reaction, the coliforms present in the water sample was determined.

Results and discussion

The results obtained for the physicochemical characteristics of the selected water samples were presented in Table-1 and was compared with the acceptable limits prescribed by BIS (1991) for drinking water quality.

Table-1: Physicochemical characters of selected water samples.

Physico-chemical Parameters	Sample I	Sample II	Sample III	Sample IV	Sample V	BIS Limit
Colour	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless
Odour	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless
pH	5.7	6.2	6.5	6.7	6.0	6.5- 8.5
Turbidity (NTU)	0.5	0.7	0.9	1.2	2.0	5
Electrical conductivity (mmho)	180	170	190	180	170	300
Total Solids (mg/l)	240	280	190	200	240	-
Total Suspended Solids (mg/l)	210	230	160	180	180	-
Total Dissolved Solids (mg/l)	300	500	300	200	600	500
Alkanity (mg/l)	350	200	275	385	175	600
Salinity (mg/l)	221	229	230	227	225	-
Total hardness (mg/l)	98	84	56	38	36	300
DO (mg/l)	7.9	7.6	7.7	7.5	7.8	4- 6
BOD (mg/l)	1.8	1.6	1.7	1.7	1.8	-
COD (mg/l)	1.8	1.7	1.7	1.8	1.9	-
Chloride (mg/l)	14.2	14	20	18	24	250
Sulphates (mg/l)	20	25	30	35	50	200
Fluorides (mg/l)	0.3	0.5	0.7	0.9	0.4	1.0
Nitrates (mg/l)	12	14	17	10	15	45
Iron (mg/l)	0	0	0	0	0	0.3
Nickel (mg/l)	0	0	0	0	0	0.02
Chromium (mg/l)	0	0	0	0	0	0.05

Physicochemical parameters analysis of water samples: The water samples from different stations were observed to be colourless and odourless. To prepare the food for aquatic organisms, colour seems to be an important factor. Since the water samples were colourless, the rate of photosynthesis increases. The meager odour of the water samples may be due to low microbial population.

pH is one of the important parameter which determines and correlates the acidic and alkaline nature of water. The pH of the selected water samples for the present study was found between 5 to 7 which lies within the BIS limit (6.5 to 8.5).

Turbidity is the optical property that causes light to be dispersed and absorbed rather than transmitted in straight line through the sample. The values of turbidity ranged from 0.5 to 2NTU which falls within the BIS recommended turbidity value for drinking water (5NTU). The low turbidity level in water was often linked with decreased number of pathogenic microbes which does not affect the water quality.

Electrical conductivity is the measure of water capacity to convey electricity or the capability of a solution to carry out an electrical current is directed by the movement of solutions and is reliant on the nature and number of the ionic groups present in that solution. Electrical conductivity value ranged from 170 to 190 mmho which was within the prescribed BIS limits (300mmho). Pure water is a poor conductor of electricity, when dissolved salts are higher it shows high conductivity. Thus conductivity is proportional to the amount of salts dissolved in water and it is an important tool to evaluate the purity of water[9].

Total suspended solids are the most important water pollutant which acts as a vector for many causative pathogens. Due to its smaller size and greater surface area per unit mass of particles, it carries pollutant load and habitat for pathogens. The likelihood for disease causing microbes is proportional to the turbidity and total suspended solids. Total dissolved solids are also considered as an indicator to assess the water quality since it affects the aesthetic value of the water by increasing the turbidity[10]. The TS, TSS and TDS ranged from 190- 280mg/l, 160- 230mg/l and 200- 600mg/l respectively. The above parameters were found to fall within the limits prescribed by BIS for drinking water (Table-1). Decrease in these parameters in the selected water samples shows that the water is palatable for human consumption and may be used for agricultural, industrial and household purposes.

Alkalinity comprises both carbonates and bicarbonates that measure the basic property of water and its serves as a stabilizer for pH[11]. In the present study the total alkalinity ranged from 175 to 385 mg/l which was low when compared with BIS limit for drinking water and irrigation purposes (600mg/l). Alkalinity with less than 100mg/l is desirable for human use[12]. Moreover the water samples were found to be less alkaline which may cause deterioration of plumbing and increases the chance for release of many heavy metals in the water bodies.

Salinity is very important factor to be considered in water bodies. The total salinity was noted as 221-230mg/l in the selected water samples. Low salinity cannot cause any harmful effect on plants, aquatic species and human beings[13]. Since the salt content was low it may increases the crop germination and density, and also vegetative development, reducing productivity and leads to generalized plant growth and increases nutrient absorption[14].

Presence of calcium and magnesium ions contributes to water hardness which states the equilibrium of water. The values of total hardness in the selected water samples ranged from 36 to 98mg/l which lies within the permissible limit of BIS (300mg/l). Hardness below 300mg/l is considered potable but beyond this limits may cause gastro- intestinal irritation, and hence hardness does not constitute any direct health problems[15-16].

Dissolved oxygen is a vital parameter of the river, which is essential for the aerobic metabolism of aquatic life, and plays an important role in the determination of water quality; particularly the water body is greatly influenced by temperature, photosynthetic activity and respiration[17]. The values of dissolved oxygen in the selected water samples ranged from 7.5 to 7.9mg/l. The increased DO was enhanced by low concentration of organic matter[18].

Biochemical oxygen demand determines the quantity of oxygen that microbes devour while decomposing organic matter whereas chemical oxygen demand is the measure of capability of water to consume oxygen in decomposition of organic and inorganic matters. The values of BOD and COD ranged from 1.6 to 1.8mg/l, which does not affects the aquatic fauna, submerged plants and beneficial microbes present in the water bodies[19].

Chloride in the aqautic system may be due to the presence of anthropogenic sources, domestic waste waters, base-exchange phenomena, elevated temperature, discharge of waste from septic tanks and low rainfall. Higher amount of chloride in the water samples cause unpleasent tase to water and also a risk factor to human health. In the present study, the chloride values ranged from 14 to 24mg/l, which lies within the BIS limit (250mg/l). Low level of chloride content in the water samples does not cause any harm to human beings and those are habituated to low chloride level may not be subjected to laxative effect and it is also indicates the presence of meager amount of organic matter[20,21].

The level of sulphate ranged from 20 to 50mg/l in the tested water samples. Sulphate occurs in natural waters at a concentration up to 400mg/l of 1000mg/l and causes water hardening in excess level. Sulphate is present in water having contact with certain geological formations such as pyrite, lignite and coal[10].

Surface water usually contains fluoride dissolved by geological formation. The desirable BIS limit of fluorides is 1mg/l, beyond

this limit the water is considered as poor quality. From the study it was evident that selected water samples have good range (0.3-0.9mg/l) of fluorides[22].

Presence of nitrate in water system may be contributed by organic sources or from industrial and agricultural chemicals. Nitrogen is found to be an essential constituent in all living organisms and determines the productivity of the auatic system. But the concentration of nitrate greater than 45mg/l can cause blue baby syndrome amid infants. The values of nitrate concentration ranged from 10 to 17mg/l which proves that the water does not cause eutrophication[23].

Iron is biologically important facet which is necessary to all biota, an essential element for human nutrition and metabolism and present in hemoglobin system. High concentration of iron causes slight toxicity and causes hemochromatosis in tissues[24]. The result showed that the concentration of iron is nil for all the selected water samples which fall within the permissible limit of BIS (0.3mg/l).

The presence of heavy metal namely nickel and chromium in the selected water sample was negligible and it indicates that the water is devoid of heavy metal pollution.

Microbiological analysis: The potability of water is determined by the analyzing the bacteria present in it. The number of bacteria and fungi was recorded as $8x10^5$ to $14x10^5$CFU/ml and $7x10^5$ to $13x10^5$CFU/ml respectively in the selected water samples. The presence of microbial colonies may be due to the organic matter dissolved in the water bodies which render it to be slightly contaminated. The total colonies were detected to be 7 in MPN technique which was within potable the limits.

Conclusion

The present study provides baseline information on the physico-chemical quality of the water samples collected from different stations of Pilloor dam. The present study revealed the eminence of Pilloor dam water samples which was not deteriorated, found to be harmless for human consumption and can be used for domestic and irrigation purposes. Further, public should create awareness and appropriate care to prevent the water resources getting contaminated.

Acknowledgement

The authors wish to place their record of thanks to the authorities and management of Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, for the successful conduct of the study.

References

1. Ali S.S., Anwar Z. and Khattak J.Z.K. (2012). Microbial analysis of drinking water and water distribution system in new urban Peshawar. *Current Research Journal of Biological Sciences*, 4(6), 731-737.

2. Bhardwaj R.M. (2005). Water quality monitoring in India: Achievements and Constraints. IWG-Env, International Work Session on Water and Statistics, Vienna, 20th - 22nd June. 1-12.

3. Goel P.K. and Bhosale P.M. (2001). Studies on the river Panchganga at Kolhapur with special reference to human impact on water quality. In: Tripathy, G.; Pandey, G. C. (Eds.). *Current topics in environmental sciences***.** [S.l.]: ABD Publishers, 108-122.

4. Patil Y.S., Patil S.K., Dhande A.D. and Pawar N.S. (2003). Water quality of river Tapti at Bhusawal Town. *Indian Journal of Environmental Protection*, 23(6), 620-623.

5. Maity P.B., Saha T., Ghosh P.B. and Bandopadhyay T.S. (2004). Studies on pollution status of Jalangi river around Krishnanagar city in West Bengal. *Science and Culture*, 70 (5/6), 191-194.

6. Geldreich E.E. (1990). Microbiological quality of source waters for water supply. McFeters G.A. (Ed.), Drinking Water Microbiology. *New York, NY: Springer-Verlag,* 3-31.

7. Antony R.M. and Renuga F.B. (2012). Microbiological analysis of drinking water quality of Anathanar channel of Kanyakumari district, Tamilnadu, India. *Ambi – Agua, Taubate*., 7(2), 42-48. http://dx.doi.org/10.4136/ambi-agua.881.

8. APHA-AWWA-WPCF (2005). Standard methods for the examination of water and waste water. 21st edition, American Public Health Association, Washington, DC, USA.

9. Masood A. and Krishnamurthy R. (1990). Hydrobiological studies of Wohar reservoir Aurangabad (Maharashtra State) India. *Journal of Environmental Biology,* 11(3), 335-343.

10. Ho K.C., Chow Y.L. and Yau J.T. (2003). Chemical and microbiological qualities of East River (Dongjiang) water, with particular reference to drinking water supply in Hong Kong. *Chemosphere*, 52(9), 1441-1450. http://dx.doi.org/10.1016/S0045-6535(03)00481-8.

11. Lechevallier W.M., Evans T.M. and Seidler J.R. (1981). Effect of turbidity on chlorination efficiency and bacterial persistence in drinking water. *Applied and Environmental Microbiology*, 42(1), 159-167. http://dx.doi.org/0099-2240/81/070159-09$02.00/0.

12. Loganayagi A., Damodarkumar S. and Murugesan S. (2008). Quality of drinking water in and around Thiruvallur district, Tamil Nadu. *Nature Environment and Pollution Technology*, 7(1), 133-138.

13. BIS (1991). Indian Standard for drinking water. Bureau of Indian Standard, New Delhi, India, 1-9, 179-182.

14. Agarwal A. and Saxena M. (2011). Assessment of pollution by physicochemical water parameters using regression analysis: A Case Study of Gagan River at Moradabad-

India. *Advances in Applied Science Research,* 2(2), 185 - 189.

15. Manivasakam N. (2005). Physico-chemical examination of water, sewage and industrial effluent. 5th edn. Pragati Prakashan, Meerut, India, 50-60. ISBN**:** 8175568346.

16. Reda A.H. (2016). Physico-chemical analysis of drinking water quality of Arbaminch town. *Journal of Environmental and Analytical Toxicology,* 6(2), 356. http://dx.doi.org**/**:10.4172/2161-0525.1000356

17. Bhave S.K. and Borse P.V. (2001). Seasonal variation in temperature, dissolved oxygen, pH and salinity and their influence on planktons in Aner river water, Jalagon, Maharastra. *Pollution Research*, 20(1), 79-82.

18. Rana B.C. and Palharia S. (1988). Physiological and physicochemical evaluation of the River Ayad, Udaipur. *Phycos*, 27, 211-217.

19. Arumugam K. (2013). Assessment of groundwater quality in Tirupur region. Ph.D thesis, Anna University, Chennai.

20. Godghate A.G., Sawant R.S. and Jadhav S.D. (2013). An evaluation of physico-chemical parameters to assess borewell water quality from Madyal and Vadgaon villages of Kagal Tahsil, MS, India. *International Research Journal of Environmental Sciences*, 2(5), 95-97.

21. Yadav G. (2002). Variation in chloride concentration in a pond at Fatehpur Sikri, Agra. *Geobios*, 29, 197-198.

22. Karthikeyan N., Saranya A. and Sashikkumar M.C. (2013). Spatial analysis of groundwater quality for Virudhunagar district, Tamil Nadu using GIS. *International Journal of Remote Sensing and Geoscience,* 2(4), 23-30.

23. Lokeshwari H. and Chandrappa G.T. (2006). Impact of heavy metal contamination of Bellandur lake on soil and cultivated vegetation. *Current Science*, 91(5), 622-627.

24. Vijayakumar G., Baskar G. and Senthilnathan K.P. (2014). Study of physico-chemical characteristics of groundwater at Ariyalur Block, Tamilnadu, India*. Journal of Chemical and Pharmaceutical Research*, 6(10), 184-188.

25. Kolekar S.S. (2017). Physico-chemical status of Bhima, Bhama and Indrayani river flowing through Khed Taluka, Rajgurunagar, Pune District*. Pollution Research,* 36(2), 340-342.