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Physico Chemical and Microbial Analysis of Different River Waters in Western Tamil Nadu, India

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Abstract

The environmental quality is greatly focused on water because of its importance in maintaining the human health and health of the ecosystem. Many parts of the world are facing water scarcity problem due to limitation of water resources coincided with increasing population. Rivers are vital freshwater systems that are critical for the sustenance of life. In the present study, river water samples were collected in the period between January – March 2012 from different parts of western Tamil Nadu, India and various physico-chemical and microbial analyses were performed based on standard methods. The comparative results showed the pH (7.5 to 10.0), DO (8-16 mg/ml), BOD (2.5 -7.5 mg/L), COD (14.5 -15 mg/L), total hardness (100-520 mg/L), calcium (80-200 mg/L), magnesium (20-320 mg/L), number of bacterial colonies(100-120 CFU) and number of fungal colonies(30-45 CFU).

Keywords: Physicochemical, microbial, pollution, Tamil Nadu

Introduction

Water is a resource that has many uses, including recreation, transportation, and hydroelectric power, domestic, industrial, and commercial uses. Water also supports all forms of life and affects our health, lifestyle, and economic well being. Although more than three quarters of the earth's surface is made up of water, only 2.8 percent of the Earth's water is available for human consumption[1]. At present, approximately one-third of the world's people live in countries with moderate to high water stress and the worldwide freshwater consumption raised six fold between the years 1900 and 1995 more than twice the rate of population growth. Thus, many parts of the world are facing water scarcity problem due to limitation of water resources coinciding with growing population[2].

Fresh water is a finite resource, essential for agriculture, industry and even human existence, without fresh water of adequate quantity and quality, sustainable development will not be possible[3]. Rivers play a major role in assimilation or carrying off of municipal and industrial wastewater and runoff from agricultural land, the former constitutes the constant polluting source whereas the later is a seasonal phenomenon[4]. With the rapid development in agriculture, mining, urbanization, and industrialization activities, the river water contamination with hazardous waste and wastewater is becoming a common phenomenon.

In India almost 70% of the water has become polluted due to the discharge of domestic sewage and industrial effluents into natural water source, such as rivers, streams as well as lakes[5]. The improper management of water systems may cause serious problems in availability and quality of water[6]. Since water quality and human health are closely related, water analysis before usage is of prime importance. Certain physical, chemical and microbiological standards, which are designed to ensure that the water is palatable and safe for drinking before it can be described as potable[7]. Therefore, present study was aimed to analyze the comparative physicochemical and microbial analysis of five river water samples using standard methods.

Material and Methods

Study area and collection of water samples: Water samples were collected from five different rivers located in western Tamilnadu, India from the post monsoon period (January 2012 to March 2012). The sampling sites and their located districts are shown in table 1. In each river, samples were collected from different areas and mixed in a single sterile polyethylene bottle. The water samples were taken by pumping in order to avoid contamination from the surface of river basin. The samples were stored in 4^{o}C for further analysis.

Physico chemical analysis: The parameters like pH, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), total hardness (TH), calcium and magnesium were analyzed using standard procedures [8].

Microbial analysis: The microbial analysis like the numbers of bacterial and fungal colonies were measured by standard plate count (SPC) using standard nutrient agar and potato dextrose agar respectively. Microbial analysis of river water samples were studied within 24 h of collection. The numbers of bacterial colonies were counted by colony counter. All

estimations were carried out using three replicates. The data are presented as mean of three independent determinations.

Results and Discussion

Physico chemical analysis of the water samples done using standard procedures showed results as plotted in figures 1-7. The pH of water is extremely important. The pH values analyzed using pH meter was found to be more or less similar for each sample, where values were ranging from 7.5-10. pH should be in the range of 6.5 to 8.5 for drinking and domestic purposes[9]. The Aliyar river water was found to have the highest pH value (9.76±0.2) and the lowest (7.5±0.3) was for Amaravathi as observed in figure-1. The pH value for Amaravathi river was found to be more or less similar to that obtained by Sivakumar *et al.*[10]. The fluctuations in optimum pH ranges may lead to an increase or decrease in the toxicity of poisons in water bodies [11].

The pH obtained in the river waters was within the ranges suitable for aquatic life[12]. Based on these guidelines, the pH of the river water would not adversely affect its use for domestic and recreational purposes. The well buffered nature of the river water can be attributed to the fact that, normally, running waters are influenced by the nature of deposits over which they flow[13].

Comparative study of dissolved oxygen showed that Amaravathi river water had the highest amount (15.475±0.4 mg/L) while Siruvani river water had the lowest (7.737 ±0.2mg/L) observed in figure-2. These results were positively correlated with the dissolved oxygen values in the drinking water of Patil *et al.*[14]. The reason for the low dissolved oxygen content was due to high decomposition of organic matter, which indicates a high pollution load in the water. The deficiency of the oxygen in the water is shelter for bacteria and other pathogens, which are anaerobic and injurious to human health[15].

Shanmuga river water had the highest BOD amount (7.737±0.2 mg/L) while Siruvani river water had the lowest (2.579±0.1 mg/L), which indicated that Shanmuga river water is highly contaminated and observed in figure-3. Comparison of COD showed that Aliyar river water had the highest amount (14.863±0.3 mg/L) while Siruvani river water had the lowest (1.524±0.1 mg/L), which indicated that Aliyar river water is highly polluted and observed in figure-4.

BOD and COD at determine the organic as well as inorganic content in the water have also increased in the post-monsoon season. In reservoir the average values of BOD, COD recorded higher in monsoon compare to post monsoon, which could be due to acidification of water by elevated microbial degradation of organic debris and concentrated dissolved solids in monsoon period. As a momentous role of DO amount in water quality of ground water, the average concentration of DO was highest in post monsoon period and lowest in monsoon consequently increase in BOD and COD[16].

The pollution level is high (total hardness-520±5 mg/L) in Shanmuga river water while pollution least (total hardness-100±2 mg/L) in Bhavani river water and observed in figure-5. This result was positively correlated with the total hardness of the water samples collected from Chirala Town at Prakasam district[17]. The high level of total hardness is due to mixing of sewage effluents into the river. The permanent hardness is mainly caused by chlorides and sulphates[18].

Calcium level is high (200 mg/L) in Shanmuga river water while it is low (80±4 mg/L) in both Aliyar river and Bhavani river water showed in figure-6 and figure-7 showed high levels (320±6 mg/L) of Magnesium in Shanmuga river water and low levels (20±0.5 mg/L) in Bhavani river water.

This result was positively correlated with the calcium content of the drinking water samples in eastern part of the Hisar at Haryana, where the calcium content ranged from 12 to 160 mg/l in the drinking water [19]. The high quantity of calcium may be because of entry of calcium by leaching process of the rocks into the water body. The levels of Calcium and Magnesium in Amaravathi river exhibited large variation compared to that obtained by Sivakumar *et al*. Magnesium level obtained in this study was correlated with the magnesium content of the water samples analyzed by Subhadradevi Gandi *et al*.[20].

In microbial analysis the bacterial colonies ranged from 100 to 120 CFU/ml and fungal colonies ranged from 30 to 45 CFU/ml showed in figure-8. Highest microbial count was observed in Shanmuga river and lowest range observed in Siruvani river. Fecal coliforms counts/100 ml should be zero for water to be considered as no risk to human health. In general high levels of free CO_2 might be the reason for low pH values obtained in the river water samples, which may consequently affect the bacterial counts[21].

According to a study by Baxter-Potter and Gilliland[22] on straight river water shed when precipitation and stream flows are high, the influence of continuous sources for pollution. It is a common practice for people living along the river catchment to discharge their domestic and agricultural wastes as well as human excreta/wastes into rivers. In addition to using the river as a source of drinking water people use the source for bathing, washing of clothes and for recreational purposes such as swimming. Wild and domestic animals seeking drinking water can also contaminate the water through direct defecation and urination[23].

Conclusion

Physico chemical and microbial analysis was performed on fiver river water samples collected from various districts in Western Tamil Nadu, India by standard methods. These rivers are used as such as for drinking, fishing, irrigation and other domestic purposes. This study would help the water quality monitoring and management in order to improve the quality of water with maintaining better sustainable management. Results obtained showed slight variations between water qualities of the rivers. The comparative analysis suggests the distinct nature of different river water and it depends on geographical location, time zone and geological foundation. Comparatively Shanmuga river was more polluted than other four rivers. This study would help to create and develop awareness among the people to maintain the quality of the river waters.

References

1. Iskandar M. B., The effectiveness of biofilter as a treatment for domestic wastewater, University Malaysia Pahang (thesis) **(2010)**
2. UNEP. Global Environmental Outlook. United Nations Environment, **(2000)**
3. Kumar N.A., View on Freshwater environment*, Ecol. Env and Cons,* **(3),** 3 **(1997)**
4. Muduli Bipra Prasanna and Panda Chitta Ranjan. Physico chemical properties of water collected from Dhamra estuary, *International journal of environmental sciences*. **1(3), (2010)**
5. Sangu R.P.S. and Sharma S.K. An assessment of water quality of river Ganga at Garmukeshwar. *Ind. J. Ecol.,* **14(20),** 278-287 **(1987)**
6. Subba Rao C. and Subba Rao N.V., Ground water quality in residential colony, Ind. *J. Environ. Hlth.,* **37(4),** 295-300 **(1995)**
7. Tebutt T.H.Y., Principles of Quality Control, Pergamon, England, 235 **(1983)**
8. APHA. (American Public Health Association), Standard Methods for the Examination of Water and Wastewater. 18 Ed., Eds.: G. E. Greenberg, L. S. Clesceri, A. D. Eaton. Publ. Office American Public Health Association. Washington, D. C. 9-1-9-147 **(1992)**
9. WHO. World Health Organization. Guidelines for Drinking Water Quality, World Health Organization, Geneva, Switzerland **(1993)**
10. Sivakumar K.K., Balamurugan C., Ramakrishnan D. and Leena Hebsibai L., Studies on physico chemical analysis of ground water in Amaravathi river basin at Karur (Tamil Nadu), India. *Water R and D.,* **1(1)** 36-39 **(2011)**
11. Ali J., An Assessment of the Water Quality of Ogunpa River Ibadan, Nigeria. M.Sc. Dissertation. University of Ibadan, Ibadan, Nigeria **(1991)**
12. Chapman D., Water Quality Assessment, 2nd edn. EPFN Spon, London **(1996)**
13. Hynes H.B.N., The Ecology of Running Waters. Liverpool University Press, Liverpool, 555 **(1970)**
14. Patil P.R., Patil K.S. and Dhande A.D., Studies on drinking water quality in Bhusawal corporation water supply, *Ind. J. Environ. Protec.,* **22(2),** 161-164 **(2002)**
15. Radha Krishnan R., Dharmaraj K. and Ranjitha Kumari B. D., A comparative study on the physicochemical and bacterial analysis of drinking, borewell and sewage water in the three different places of Sivakasi, *Journal of Environmental Biology*, **28(1),** 105-108 **(2007)**
16. Hemant Pathak, Deepak Pathak and Limaye S.N., Studies on the physico-chemical status of two water bodies at Sagar city under anthropogenic Influences, Advances in Applied Science Research. **3(1)** 31-44 **(2012)**
17. Srinivasa, Rao B. and Venkateswarlu P., Evaluation of ground water quality in chirala town (Prakasam district). *Ind. J. Environ. Protec.,* **20(3),** 161-164 (**1999)**
18. Roy Y. and Kumar R. A., A study of water quality of the rivers of Ranchi district, *Ind. J. Environ. Protec,* **21(5),** 398-402 **(2002)**
19. Garg V. K., Gupta R., Goel S., Taneja M. and Khurana B., Assessment of underground drinking water quality in eastern part of Hisar, *Ind. J. Environ. Protec.,* **20(6)** 407-412 **(1999)**
20. Subhadradevi G., Barbuddhe S. B., Hazel D. and Dolly C., Physicochemical characteristics of drinking water at Velseo, (Goa), *J. Ecotoxicol. Environ. Monit,* **13(3),** 203-209 **(2003)**
21. Edema M.O., Omemu A.M. and Fapetu O.M., Microbiology and Physicochemical Analysis of different sources of drinking water in Abeokuta. Nigeria. Niger. J. Microbiol. **15(1),** 57-61 **(2001)**
22. Baxter-Potter W. and Gilliland M., Bacterial Pollution of Run-off from Agricultural Lands, *J. Environ. Qual.,* **17(1),** 27-34 **(1988)**
23. Karikari A.Y. and Ansa-Asare O. D., Physicochemical and microbial water quality assessment of the Densu River of Ghana. *West Afr. J. Appl. Ecol.,* **10,** 87-100 **(2006)**

Table-1
Location of sampling areas

S. No	River Name	Location	District
1	Aliyar	Pollachi	Coimbatore
2	Amaravathi	Dharapuram	Tirupur
3	Bhavani	Sathyamangalam	Erode
4	Shanmuga	Palani	Dindigul
5	Siruvani	Perur	Coimbatore

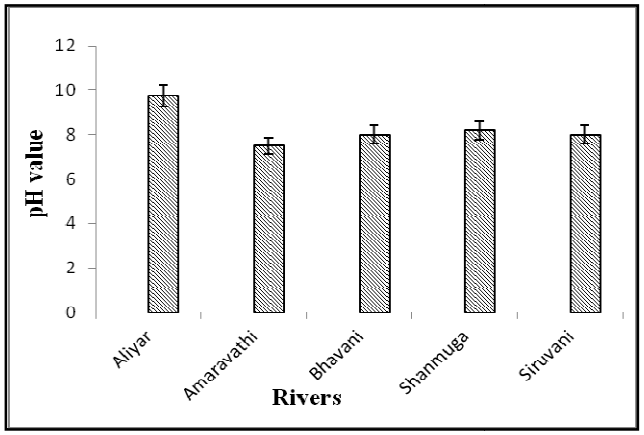

Figure-1
Comparison of pH in various river waters

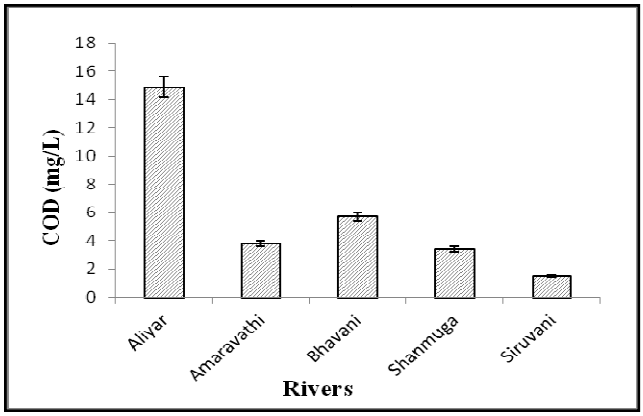

Figure-4
Comparison of COD in various river waters

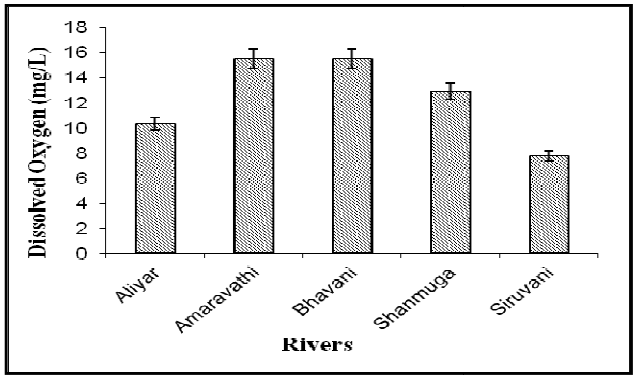

Figure-2
Comparison of Dissolved Oxygen in various river waters

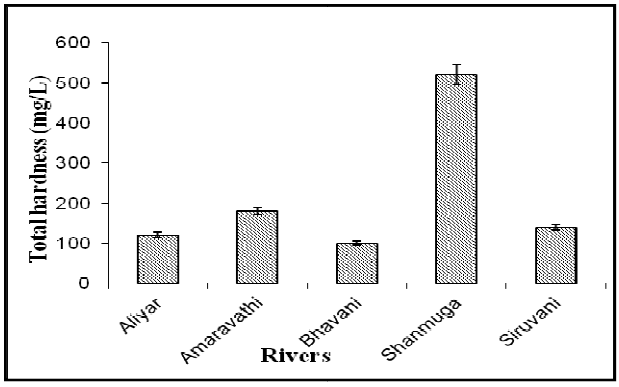

Figure-5
Comparison of Total hardness in various river water

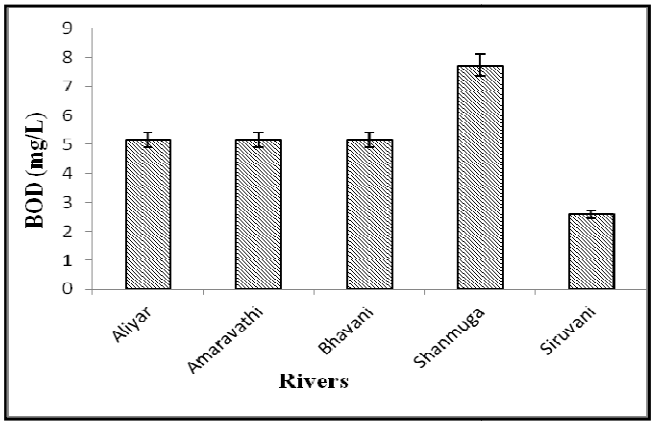

Figure-3
Comparison of BOD in various river waters

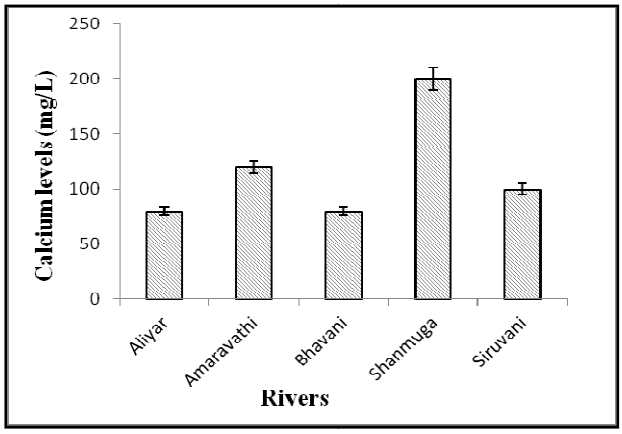

Figure- 6
Comparison of Calcium level in various river waters

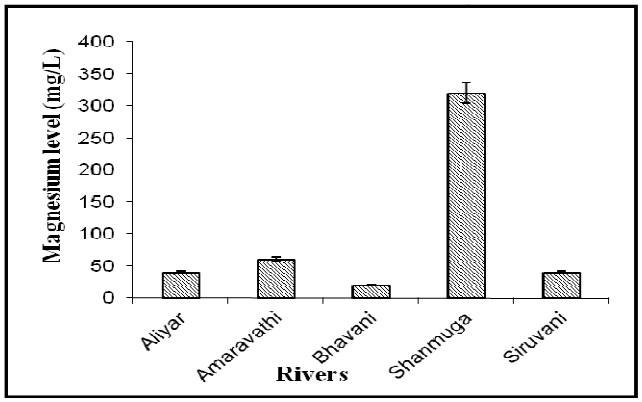

Figure-7
Comparison of Magnesium level in various river waters

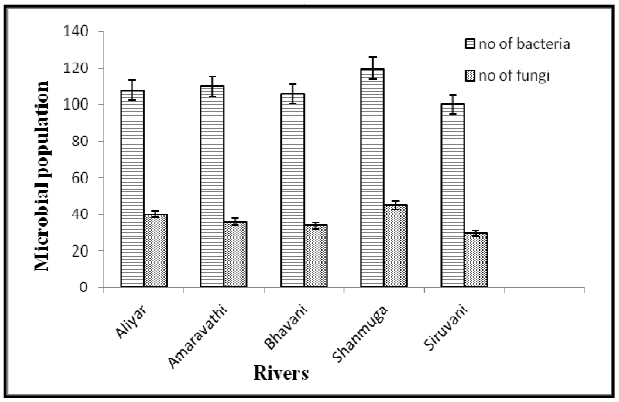

Figure-8
Compartive microbial analysis in various river waters