INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
Volume-3, Issue-1, Jan-Mar-2013 ISSN 2231-4490

Coden : IJPAES www.ijpaes.com

Received: 17th Dec-2012 *Revised: 28th Dec-2012* *Accepted: 30th Dec -2012*

Research article

SEASONAL VARIATION IN THE PHYSICO-CHEMICAL CHARACTERISTICS ALONG THE UPSTREAM OF TUNGABHADRA RIVER, WESTERN GHATS, INDIA

Sowmyashree Shetty *, N C Tharavathy , Reema Orison Lobo, Nannu Shafakatullah

Department of Biosciences, Environmental Science Division, Mangalore University, Mangalagangothri – 574 199, Mangalore, Karnataka, India.
* Corresponding author, e-mail: shettysowmya84@gmail.com

ABSTRACT: The present study was undertaken to know the variation in different seasons in response to physico-chemical properties of Tungabhadra river, Western Ghats, India. The study was carried out over a period of one year from December 2009 to December 2010. The study of physical parameters namely air temperature, water temperature, salinity, conductivity, dissolved solids, suspended solids, total solids and chemical parameters such as pH, total hardness, dissolved oxygen, total alkalinity, chloride, calcium and magnesium showed noticeable seasonal variations, which may be attributed to the local climatic conditions and water exchange mechanisms. Analysis of water quality parameters indicated that water was free from any sort of contamination since it is an unpolluted area.
Keywords: Physico-chemical properties, Seasonal variations, Tungabhadra river, Western Ghats.

INTRODUCTION

The Western Ghats (WG), located along the southwest coastline of the Indian subcontinent, is a biodiversity 'hotspot' [16] and is extremely rich in its diversity as well as endemicity [4, 7]. Tungabhadra is a major river in the south Indian peninsula. The river is in fact formed by the union of two rivers Tunga and Bhadra and hence the name. Both Tunga and Bhadra Rivers are originated on the eastern slops of the Western Ghats. The quality of a river at any point reflects several major influences, including the lithology of the basin, atmospheric inputs, climatic conditions and anthropogenic inputs [3, 24].

Water quality performs important role in health of human, animals and plants. The quality of surface water within a region is governed by both natural processes (such as precipitation rate, weathering processes and soil erosion) and anthropogenic effects (such as urban, industrial and agricultural activities and the human exploitation of water resources) [9, 13, 17, 19). A variety of methods are being used to display the information which is concealed in the quality variables observed in a water quality monitoring network [15]. The water quality parameters depend upon the hydrochemistry of the study area. In this view a survey was undertaken to know the seasonal variation in nutrient content and physico-chemical parameters of water along the upstream of the river.

MATERIALS AND METHODS

The Tungabhadra River is formed by the confluence of two rivers, the Tunga River and the Bhadra River, which flow down the eastern slope of the Western Ghats in the state of Karnataka. Along with are Nethravathi (west flowing river, joining the Arabian Sea near Mangalore), the Tunga and the Bhadra rise at Gangamoola, in Varaha Parvatha in the Western Ghats. Bhadra river flows through the Industrial City Bhadravathi as more than one hundred tributaries, streams, creeks, rivulets and contribute to each of these two rivers [18, 23]. The Tunga Bhadra is the study area from where one particular site was selected which was free from pollution. Surface water samples were collected for the physico-chemical analysis. The physico-chemical parameters selected to assess the quality of water in Tungabhadra river were colour, odour, temperature, electrical conductivity (EC), Total suspended solids (TSS), Total dissolved solids (TDS), total solids (TS), pH, total alkalinity, total hardness, calcium, magnesium, dissolved oxygen (DO), salinity and chloride. All these parameters were analysed according to the standard procedure explained in [2, 25].

RESULTS AND DISCUSSION

When the river water mixes with sea water, some changes take place, which may influence the water quality [22]. The physico-chemical parameters showed noticeable seasonal variations (Fig. 1-6), which may be attributed to the local climatic conditions and water exchange mechanism. Variations in nutrient contents and other physico-chemical characteristics of the study stations depend on several factors such as days of sampling, time of sampling and nature of effluents discharged to the sampling stations before or during the sampling.
Temperature is one of the important factor in the ecosystem, which may influence the distribution and abundance of flora and fauna. The water temperature values varied from 20°C to 33.5°C. The highest and lowest values were observed during pre-monsoon (April) and monsoon (August) seasons, respectively. Higher temperature values recorded in the dry season may be because of heat raising temperature of surface water. In monsoon season cloudy sky and rainfall brought down the temperature to the minimum [10].

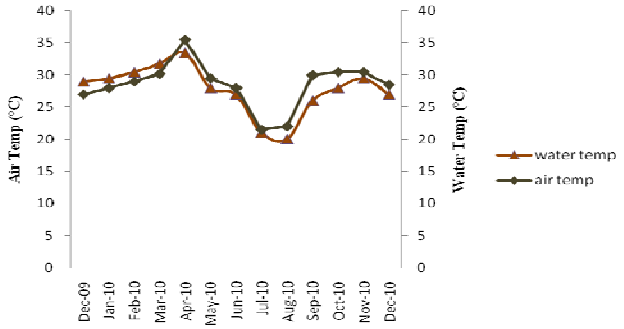

Fig. 1: Comparison of Air and water temperature during Pre-monsoon. (February-May), Monsoon (June-September) and Post-monsoon (October-January) seasons.

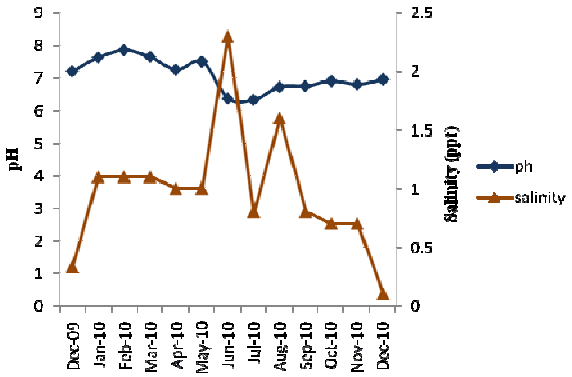

Fig. 2: Relation between pH and Salinity in various seasons.

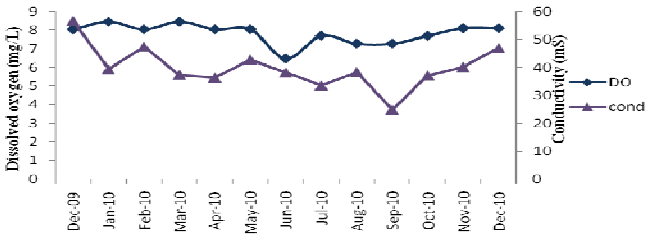

Fig. 3: Variations between DO and EC during different seasons.

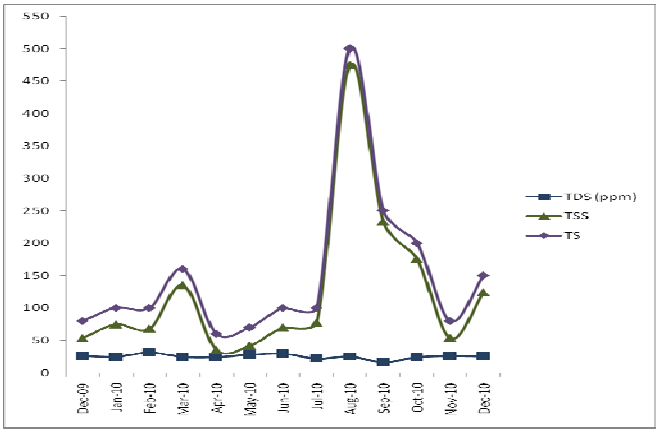

Fig. 4: Relation between TDS, TSS and TS during various seasons.

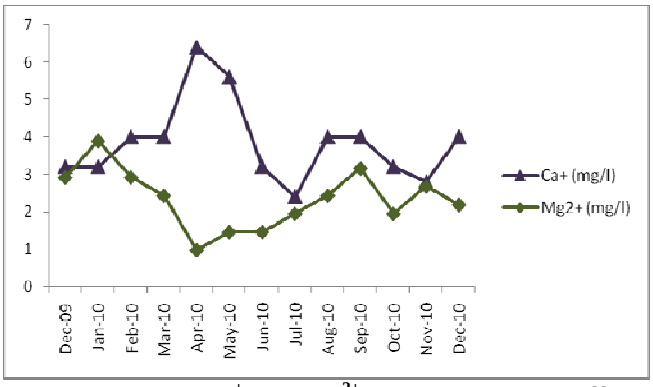

Fig. 5: Variations between Ca^{+} and Mg^{2+} hardness during different seasons.

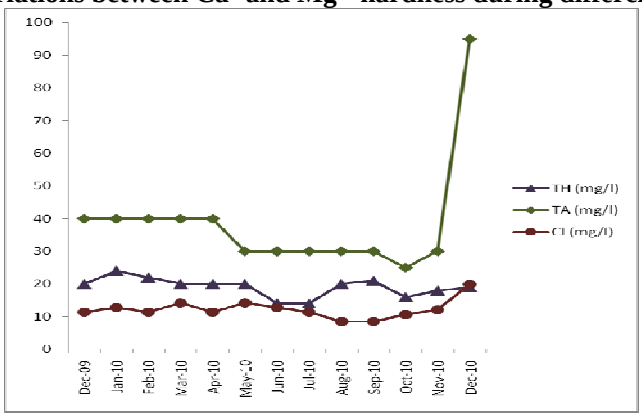

Fig. 6: Relation between TH, TA and Cl during various seasons.

The pH values showed no marked fluctuations. It remained alkaline (6.3-7.8) throughout the study period in all the seasons. Highest and lowest values were observed during pre-monsoon (February) and monsoon (July) seasons, respectively. Higher acidity during pre-monsoon was due to the uptake of CO_2 by photosynthesizing organisms. Lower acidity during the monsoon season may be due to the influence of fresh water influx, low temperature and organic matter decomposition [25]. The observed salinity values ranged from 0.1ppt to 2.3ppt. The highest value was noticed during monsoon (June) and lowest value during post-monsoon (December) seasons. In the present study, the lower salinity was recorded during post-monsoon season which may be due to large quantity of freshwater inflow resulting in the dilution of water and hence causes reduction in salinity [20]. The salinity of water indicates the presence of ionic substances that may come from the reaction of metals and acids containing in water.

The conductivity values were ranged from 24.9mS to 56.6mS and it was high during post-monsoon (December) season. In most practical oceanographic applications, the change of conductivity is dominated by temperature. In aquatic systems, oxygenation is the result of an imbalance between the process of photosynthesis, degradation of organic matter, re-aeration [8] and physicochemical properties of water [1]. The dissolved oxygen content varied from 6.49mg/L to 8.51mg/L. Dissolved oxygen (DO) is needed for waste degradation and decomposition by microorganism. The increase in DO observed in post-monsoon (January) season could be attributed to the input of DO-rich fresh water during the post-monsoon period. An adequate supply of dissolve oxygen is essential for the survival of aquatic organism [6]. The TDS values of the study area lies between 16.7ppm and 31.4ppm. The total suspended solids (TSS) varied from 35.6ppm to 474.9ppm and the total solids (TS) ranged from 60.1ppm to 500.6ppm. The total dissolved solids (TDS) mainly indicate the presence of various kinds of minerals like ammonia, nitrite, nitrate, phosphate, alkalis, some acids, sulphates and metallic ions etc which are comprised both colloidal and dissolved solids in water. It is also an important chemical parameter of water [11]. In most fresh waters, total hardness is mainly imparted by the calcium and magnesium ions, which apart from sulphate, chloride and nitrate are found in combination with carbonates and bicarbonates. In the present study total hardness showed higher values in post-monsoon season due to reduced inflow and evaporation followed by pre-monsoon and monsoon. The values of total hardness (TH) in river water varied from 14mg/L to 24mg/L. The hardness of water depends upon the dissolved salts present in the water [21].

The values of total alkalinity (TA) in river water varied from 25mg/L to 95mg/L. The values of Mg^{2+} hardness varied between 0.97mg/L and 3.89mg/L. Mg^{2+} hardness exhibit strong relation with Cl which reveals that magnesium mainly remains present as $MgCl_2$ [5]. The values of Ca^{+} hardness lie between 2.41mg/L and 6.41mg/L. The presence of calcium in the water is more likely in the form of carbonate, which is also indicated by high values of hardness in water samples [12].

Chloride occurs naturally in all type of waters. High concentration of chloride is considered to be the indicators of pollution due to organic wastes of animal or industrial origin. High values of chloride are troublesome in irrigation water and also harmful to aquatic life [27]. The value of chloride varied between 8.52mg/L to 19.88mg/L in river water with maximum value of 19.88mg/L in December 2010 and lowest value of 8.52mg/L in the month of August respectively. High values of chloride in post-monsoon season may be associated with high temperature which enhances the evaporation, reducing the volume of water thus resulting in the high concentration of salts.

CONCLUSION

The study indicated that water in Tungabhadra River is free from contamination and safe for drinking and the water is of good quality for drinking purposes. The river in future may get subjected to natural contamination due to the activities of man. We have the responsibility to protect rivers and should give awareness to people about the need for protecting the river and consequences of pollution. Strict legal action should be taken against those who try to contaminate the river.

ACKNOWLEDGEMENT

The authors are thankful to the NAIP, ICAR, New Delhi for the financial support and also Mangalore University for the laboratory facilities.

REFERENCES

[1] Aston S R. 1980. Nutrients dissolved gasses and general biochemistry in estuaries, In E. Olausson and I. Cato (Eds.), Chemistry and Biogeochemistry of Estuaries, New York, Wiley, 233-262.

[2] APHA. 1998. Standard Methods for Examination of Water and Wastewater. American Public Health Association, New York, 522.

[3] Bricker O P and Jones B F. 1995. Main factors affecting the composition of natural waters, In: Salbu, B., Steinnes, E. (Eds.), Trace Elements in Natural Waters. CRC Press, Boca Raton, FL, 1-5.

[4] Bhat A. 2003. Diversity and composition of freshwater fishes in streams of Central Western Ghats, India. *Environmental Biology of Fishes* 68, 25–38.

[5] Bhandari N S and Nayal K. 2008. Correlation study on physico-chemical parameters and quality assessment of Kosi river water, Uttarakhand. *Electronic journal of Chemistry* 5(2), 342-346.
[6] Dara S S. 2002. A text book of environmental chemistry and pollution control. S. Chand and Company Limited, New Delhi, 216.
[7] Dahanukar N, Raut R and Bhat A. 2004. Distribution, endemism and threat status of freshwater fishes in the Western Ghats of India. *Journal of Biogeography* 31, 123–136.
[8] Granier J, Billen G and Palfner L. 2000. Understanding the oxygen budget and related ecological processes in the river mosel: The riverstrahler approach, *Hydrobiologia*, 410, 151–166.
[9] Jarvie H P, Whitton B A and Neal C. 1998. Nitrogen and phosphorus in east coast British rivers: Speciation, sources and biological significance. *Sci. Total Environ.*, 210-211, 79-109.
[10] Kannan R and Kannan L. 1996. Physico-chemical characteristics of sea weed beds of the Palk Bay, southeast coast of India, *Indian Journal of Marine Sciences*, 25, 358-362.
[11] Kabir E S, Kabir M, Islam S M, Mia C M, Begum N, Chowdhury D A, Sultana S M and Rahman S M. 2002. Assessment of effluent quality of Dhaka export processing zone with special emphasis to the textile and dying industries, Jahangirnagar, *Uni. J. Sci.*, 137-138.
[12] Khaiwal R, Ameena, Minakshi, Monika, Rani and Kaushik A. 2003. Seasonal variations in physicochemical characteristics of River Yamuna in Haryana and its ecological best-designated use, *Journal of Environmental Monitoring* 5, 419-426.
[13] Liao S W, Gau H S, Lai W L, Chen J J and Lee C G. 2007. Identification of pollution of Tapeng Lagoon from neighbouring rivers using multivariate statistical method, *J. Environ. Manag.*, 88 (2), 286-292.
[14] Mazlum N, Ozer A and Mazlum S. 1999. Interpretation of water quality data by principal components analysis, *Tr. J. Eng. Environ. Sci.*, 23, 19-26.
[15] Myers N, Mittermeier R A, Mittermeier C G and Kent J. 2000. Biodiversity hotspots for conservation priorities, *Nature* 403, 853–858.
[16] Mahvi A H, Nouri J, Babaei A A and Nabizadeh R. 2005. Agricultural activities impact on groundwater nitrate pollution, *Int. J. Environ. Sci. Tech.*, 2 (1), 41-47.
[17] Manjappa S, Suresh B, Arvinda H B, Puttaiah E T and Thirumala S. 2008. Studies on environmental status of Tungabhadra river near Harihar, Karnataka (India), *J. Aquqa. Biol*, vol 23(2), 67-72.
[18] Nouri J, Karbassi A R and Mirkia S. 2008. Environmental management of coastal regions in the Caspian Sea, *Int. J. Environ. Sci. Tech.*, 5 (1), 43-52.
[19] Nirmal K J I, George B, Kumar R N, Sajish P R and Viyol S. 2009. Assessment of spatial and temporal fluctuations in water quality of a tropical permanent estuarine system- Tapi, west coast of India, *Applied Ecology and Environmental Research*, 3, 267-276.
[20] Prasad N R and Patil J M. 2008. A study of physico-chemical parameters of Krishna River water particularly in Western Maharashtra, *Rasayan J. Chem.*1(4), 943-958.
[21] Prasanna M B and Ranjan P C. 2010. Physico-chemical properties of water collected from Dharma estuary, *Int. J. Environ. Sci.*, 1(2), 95-100.
[22] Ramesh C, Manoj G and Adarsh P. 2011. Monitoring of River Ram Ganga: physico-chemical characteristic at Bareilly recent research in science and technology, 3(6), 16-18.
[23] Shrestha S and Kazama F. 2007. Assessment of surface water quality using multivariate statistical techniques: A case study of the Fuji river basin, Japan, *Environ. Model. Software*, 22 (4), 464-475.
[24] Soundarapandian P, Premkumar T and Dinakaran G K. 2009. Studies on the physico-chemical characteristics and nutrients in the Uppanar estuary of Cuddalore, south east coast of India, *Curr. Res. J Biol.l Sci.* 1(3), 102-105.
[25] Trivedy R. K. and Goel P. K. 1984. Chemical biological methods for water pollution studies, Environmental publications, Karad, India, 104.
[26] Venkatesharaju K, Ravikumar P, Somashekar R K and Prakash K L. 2010. Physico-chemical and bacteriological investigation on the river Cauvery of Kollegal stretch in Karnataka, Kathmandu University, *J. Sci. Eng. Tech.* 6(1), 50-59.