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Research Note

Sci Vis 11 (2), 72-76
April-June, 2011
ISSN (print) 0975-6175
ISSN (online) 2229-6026

Assessment of the water quality of Tlawng river in Aizawl, Mizoram

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Received 24 September 2010 | Revised 8 March 2011 | Accepted 3 April 2011

ABSTRACT

The present study was conducted with an aim to assess water quality of Tlawng river, a major source of potable water in Aizawl district of Mizoram, for a period of two years, i.e. from February 2007 to January 2009. The data analysed were compared with WHO (2004) and BIS-10500 standards. The average DO content ranged from 5.83 to 6.83 mgL^{-1} where the lowest DO level shows below permissible limit; BOD from 0.48 to 0.84 mgL^{-1} which indicates a low organic content in the water; total hardness from 48.75 to 102.71 mgL^{-1} $CaCO_3$; calcium hardness from 29.14 to 56.14 mgL^{-1} $CaCO_3$; magnesium hardness from 19.66 to 46.57 mgL^{-1} $CaCO_3$ and fluoride content from 0.38 to 1.08 mgL^{-1} where some of the water samples shows below permissible limit. The DO content was negatively correlated with other parameters studied.

Key words: BOD; DO; fluoride; hardness; pollution; Tlawng river; water quality.

INTRODUCTION

The World Health Organization (WHO) has defined water pollution as 'any foreign material either from natural or anthropogenic sources that may contaminate the water supply and makes it harmful to life'.[1] Water pollution refers to deterioration of physical, chemical and biological characteristics of water leading to harmful effects on human beings, plants and animals.[2] The water pollution problem has now become a challenging task for environmentalists, as most of the surface water bodies are getting more polluted and intensity of pollutants increases with time. The usual measures are not effective, as implementation of management measures is rather poor in developing countries. In Mizoram, especially in Aizawl, majority of people are using water of Tlawng river for various purposes such as drinking, bathing and recreational purposes. Keeping this in mind, present work was conducted with an aim to assess the quality of the river water, so that the state government as well as the people may be suggested to take proper awareness on the quality of river water and its management, as the demand of water increases and the supply of fresh water is steadily increasing.

MATERIALS AND METHODS

The river Tlawng rises at a general altitude of 840 ft in an area having co-ordinate 23°45'

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E and 92°44'N (Fig. 1). Tlawng watershed is situated in the middle of the state and flows along Aizawl and Lunglei districts of Mizoram. It is largest river in the state with a length of 157.38 km. The river originates from Zobawk village at Lunglei district and flows from south to north and discharges into Barak Valley in Cachar, Assam. For present investigation, the water samples were collected from 6 different sites from upstream to downstream of Tlawng river along city of Aizawl and one PHE treated sample for comparison.

Water samples were collected from Tlawng river from seven different points at monthly intervals for various water quality analysis for a period of two years, i.e. from February 2007 to January 2009. The methods outlined in the '*Standards Methods for the Examination of Water and Wastewater*'[3] and '*Handbook of Methods in Environmental Studies, Water and Wastewater Analysis*'[4] were used for analysis of various physico-chemical attributes. DO and BOD contents were analyzed using 'Winkler's Iodide Azide Method' and result was expressed in mgL^{-1}. EDTA titration method was adopted for the determination of total hardness, calcium hardness and magnesium hardness and the result was expressed in $mgL^{-1}CaCO_3$. SPANDS method was applied for the determination of fluoride content and the result was expressed in mgL^{-1}.[3,4]

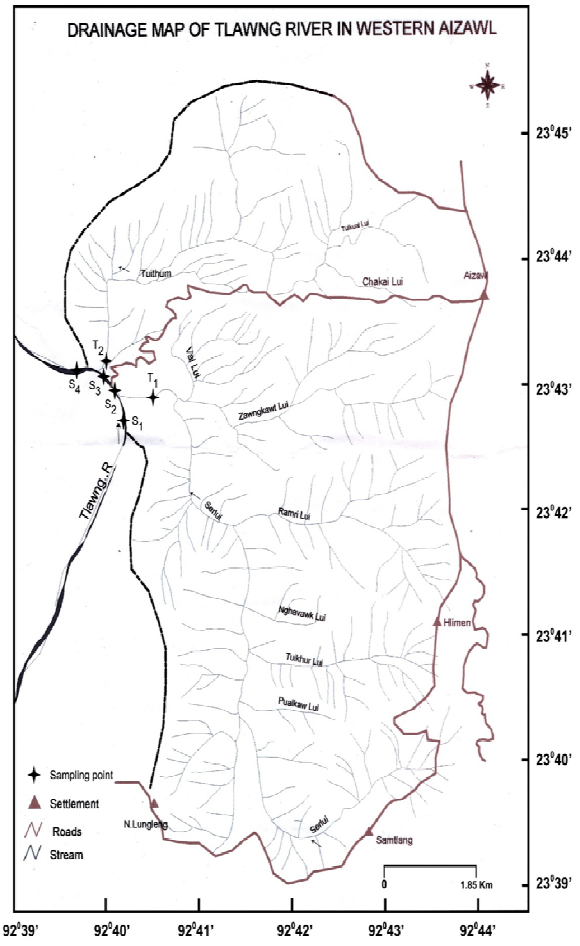

Figure 1. Drainage map of Tlawng river, Aizawl.

Results and Discussion

Dissolved oxygen (DO)

DO measures are important for maintaining aerobic conditions in natural waters that receive polluted matter. The DO content was observed to be highest in December 2007 and lowest in September 2007 (Fig. 2). A similar trend for minimum values was observed for two successive years. ANOVA revealed significant monthly difference of mean as 0.3 (at 5%). Higher DO values during winter months

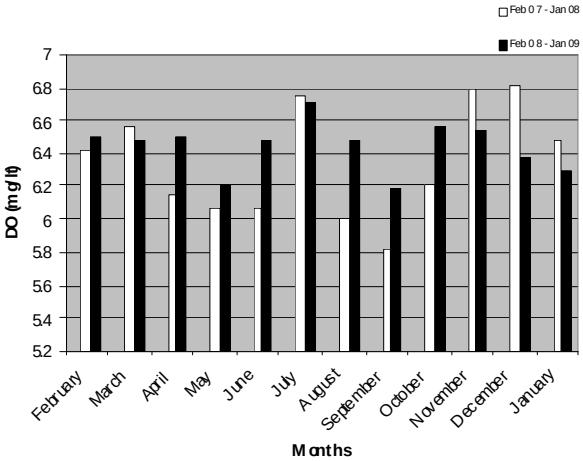

Figure 2. Monthly variation of DO from 2007-09.

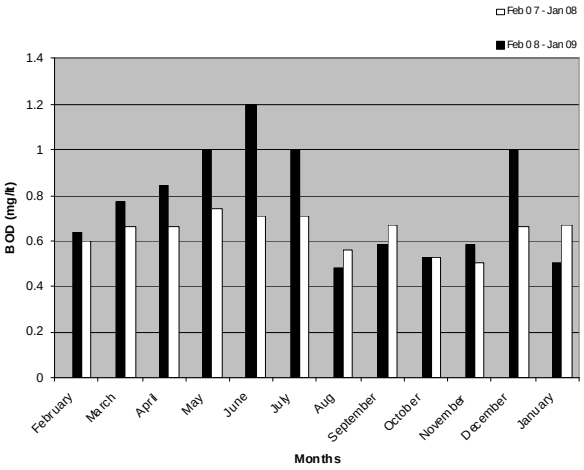

Figure 3. Monthly variation of BOD from 2007-09.

may be due to low rate of decomposition of organic waste as well as low level of wastes of organic origin.[5] The results indicate that the water were moderately clean.[4]

Biological oxygen demand (BOD)

BOD is the index of water pollution.[5-7] The value of BOD was observed to be highest in the month of June 2007 and lowest in August 2007 (Fig. 3). A similar trend for maximum and minimum values was observed for two successive years. ANOVA revealed significant monthly difference of mean as 0.13 (at 5%). Highest value in June 2007 could be attributed to the low water table followed by high rate of decomposition of organic wastes.[4,5] Higher values during monsoon months may be due to discharge of high organic waste into river water through runoff supported by high rate of decomposition. The values of BOD were within the permissible level suggested by WHO (6 mgL^{-1}) for potable water.

Hardness

Total hardness is defined as 'the sum of Ca^{2+} and Mg^{2+} concentrations expressed as calcium carbonate in mgL^{-1} or ppm.' Calcium hardness is due to Ca^{2+} only and magnesium hardness is due to Mg^{2+}.[8,9] Total hardness was found to be highest in March 2008 and lowest in July 2007. A similar trend for maximum and minimum values was observed for two successive years. ANOVA revealed significant monthly difference of mean as 4.7 (at 5%). The hardness values were found to be higher during summer months which may be due to low volume of water and high pollution load of waste water discharged into the river. The total hardness of all the samples were within the permissible limit prescribed by WHO (500 mgL^{-1} $CaCO_3$).

Calcium hardness was found to be highest in March 2008 and lowest in August 2007. A similar trend for maximum and minimum values was observed for two successive years. ANOVA revealed significant monthly difference of mean as 2.4 (at 5%). All the water samples were within the permissible value of calcium hardness by WHO (75 mgL^{-1} $CaCO_3$).

Magnesium hardness was found to be highest in March 2008 and lowest in July 2007. A similar trend for maximum and minimum values was observed for two successive

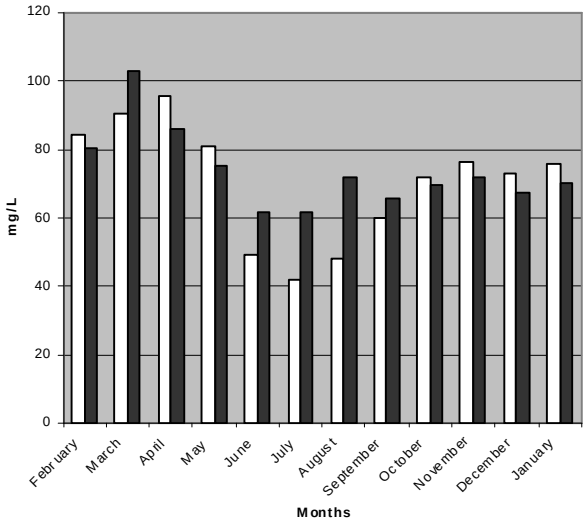

Figure 4. Monthly variation of total hardness from 2007-09.

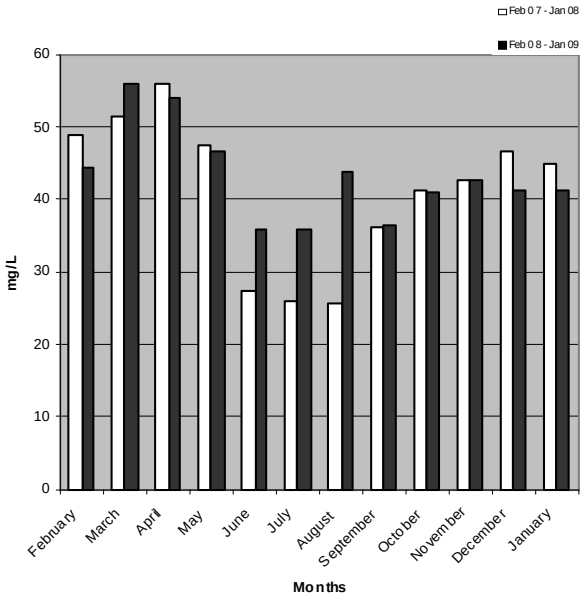

Figure 5. Monthly variation of calcium hardness.

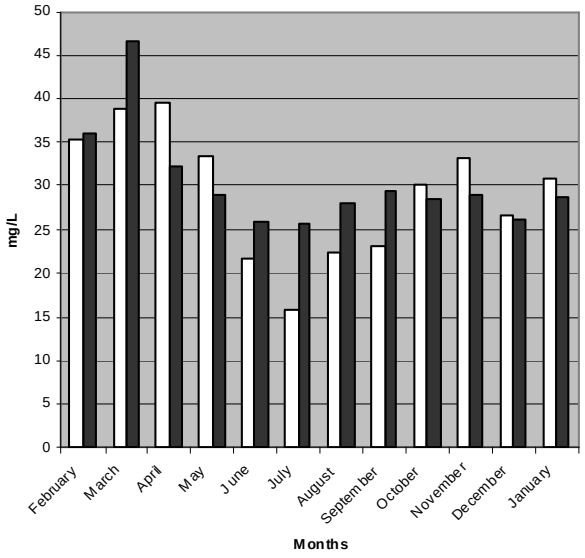

Figure 6. Monthly variation of magnesium hardness.

years. ANOVA revealed significant monthly difference of mean as 3.2 (at 5%). The permissible limit for magnesium hardness suggested by WHO is 30 mgL^{-1} $CaCO_3$. The highest value of magnesium hardness was found in March 2008, which is 46.57 mgL^{-1} $CaCO_3$.

Fluoride

Fluoride is found in all natural waters at some concentration. Fluoride is beneficial if taken in controlled quantity of less than 1 mgL^{-1} but known to cause serious health problems if taken beyond permissible level.[10,11] Fluoride content was found to be highest in March 2008 and lowest in July 2008. The maximum and minimum values were found to be varied for the two successive years; this may be due to intensity of rainfall. ANOVA revealed significant monthly difference of mean as 0.045 (at 5%). The suggested permissible limit for fluoride by WHO is 1.5 mgL^{-1}.

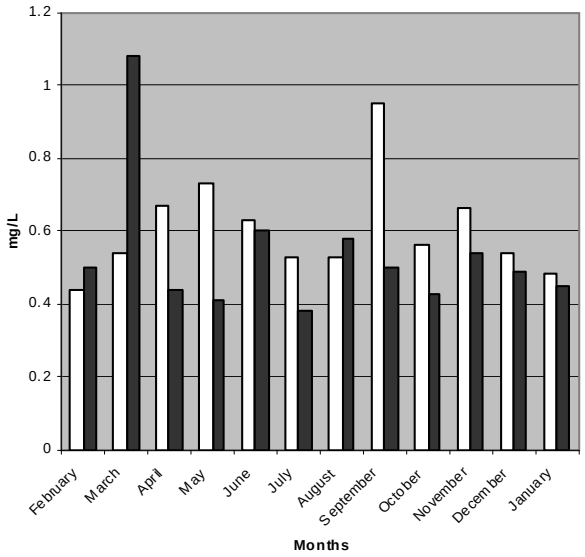

Figure 7. Monthly variation of fluoride content.

CONCLUSIONS

According to the results, Tlawng river is a pristine river and is under Class A. The higher level of DO in winter months may be due to high solubility of oxygen in low water temperature. Self purification of the water causes

decrease in BOD, but increase again because of the point and non-point source of pollution.[12] In case of total hardness and calcium hardness, the values of the water samples are within the WHO standards. But in case of magnesium, 1.9 % of samples are higher than permissible limit. Calcium and magnesium together comprise most natural water hardness. The high level of hardness can result in cake deposition, particularly when heating the water and can lead to an increased incidence of urolithisis.[13,14] Except for a few months, most of fluoride content was within the permissible limit, but, the fluoride content is usually on lower side which can be supplemented by food and toothpaste. Since the demand and scarcity of water is increasing day by day, regular monitoring of water quality and management of water resources should be taken up.

ACKNOWLEDGEMENT

The authors are thankful to the UGC, New Delhi, for providing Rajiv Gandhi National Fellowship. The Mizoram University is gratefully acknowledged for extending infrastructure and other faculties required for successful completion of work.

REFERENCES

1. WHO (2004). *Guidelines for Drinking Water Quality, Vol I. 3rd Edition.* Geneva, Switzerland.
2. *Manual of Specifications for Drinking water,* BIS: 10500-1983, New Delhi.
3. APHA (2005). *Standard Methods for the Examination of Water and Wastewater, 21st Edition*. American Public Health Association, Washington D.C.
4. Maiti SK (2001). *Handbook of Methods in Environmental Studies. Vol I: Water and Wastewater Analysis.* ADB Publishers, Jaipur.
5. Bharali J, Baruah BK & Sarma HP (2008). Studies on physico-chemical characteristics of water of the wetlands in Kaziranga National Park, Assam. *Poll Res*, **27,** 591-597
6. Kudesia VP (2003). *Water Pollution.* Pragati Prakashan, Meerut. pp. 545-546.
7. Deshmukh JU, Ambore NE & Pulle JS (2006). BOD variations in Godavari river at Nanded city due to impact of industrial pollution. *Ecol Environ Conserv*, **12**, 533-534
8. Chhatwal GR, Katyal T, Mohan K, Mehra MC, Satake M & Nagahiro T (2003). *Environmental Water Pollution and its Control.* Anmol Publications Pvt. Ltd, New Delhi.
9. De AK (2003). *Environmental Chemistry 5th Edition.* New Age International Publishers, New Delhi.
10. Sutapa C, Jayashree D & Sarma HP (2009). Fluoride in drinking water in Guwahati City: A plan for effective removal techniques. *Poll Res*, **28**, 97-100.
11. Fawell J, Chilton J, Dahi F, Fewtrell L & Magara Y (2006). *Fluoride in Drinking Water*. T.J. International (Ltd), Padstow, Cornwall, U.K.
12. Hasanzadeh HH (2008). Water quality, physico-chemical and biological characteristics of Tajan River. *J Ind Poll control,* **24**, 169-176
13. WHO (1984). *Guidelines for Drinking Water Quality, Vol 2.* Health criteria and other supporting information, Geneva, Switzerland.
14. WHO (1993). *Guidelines for Drinking Water Quality, Vol 1. Recommendation, 2nd edition.* Geneva, Switzerland.