



Physico-chemical characteristics of Tamdil in Mizoram, northeast India

B.P. Mishra and Lalzahawmi Chenkual*

Department of Environmental Science, Mizoram University, Aizawl 796004, India

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ABSTRACT

In order to understand the water quality of Tamdil, its physico-chemical parameters were analyzed for a period of one year, i.e. from October 2013 to September 2014. For detailed investigation, water quality attributes namely, water temperature (12.5°C-26.3°C), pH (6.6-7.4), turbidity (0.22 -10.4 NTU), acidity (3.2-13 mg/L), total alkalinity (32-107.2 mg/L), total hardness (26.8-50.4 mg/L), nitrate-N (0.02-0.82 mg/L), phosphate-P (0.02-0.53 mg/L), dissolved oxygen (4.4 -7.36 mg/L) and biological oxygen demand (0.029-1.2mg/L) were studied. The results reveal that there is a significant seasonal variation in physico-chemical attribute and the data in all parameters are within the prescribed limit of water quality standard laid down by various scientific agencies.

Key words: Acidity; dissolved oxygen; total alkalinity; total hardness; Tamdil; water quality.

INTRODUCTION

Water, due to its great solvent power, is constantly threatened to get polluted easily. The requirement of water in all forms of lives, from micro-organisms to human, is a serious problem today because all water resources have reached a point of crisis due to unplanned urbanization and industrialization.¹

Lakes are one of the important natural wetlands. Wetlands are the transitional zones that occupy the intermediate position between dry land and open water. They encompass diverse

and heterogeneous habitat ranging from rivers, flood plains and rain fed lakes, to swamp, estuaries and marshes.² Government of India, under National Lake Conservation Plan (NCLP) approved a programme for conservation and management of polluted lakes in May, 2001. The objective of the scheme was to restore and conserve polluted and degraded lakes and other similar bodies namely tanks, talabs, etc.³ 115 wetlands in India are identified under National Wetland Conservation Programme (vide D.O.No.J/2201/01/10-CS(W)), out of which two lakes, viz Tamdil and Palak are located in Mizoram.

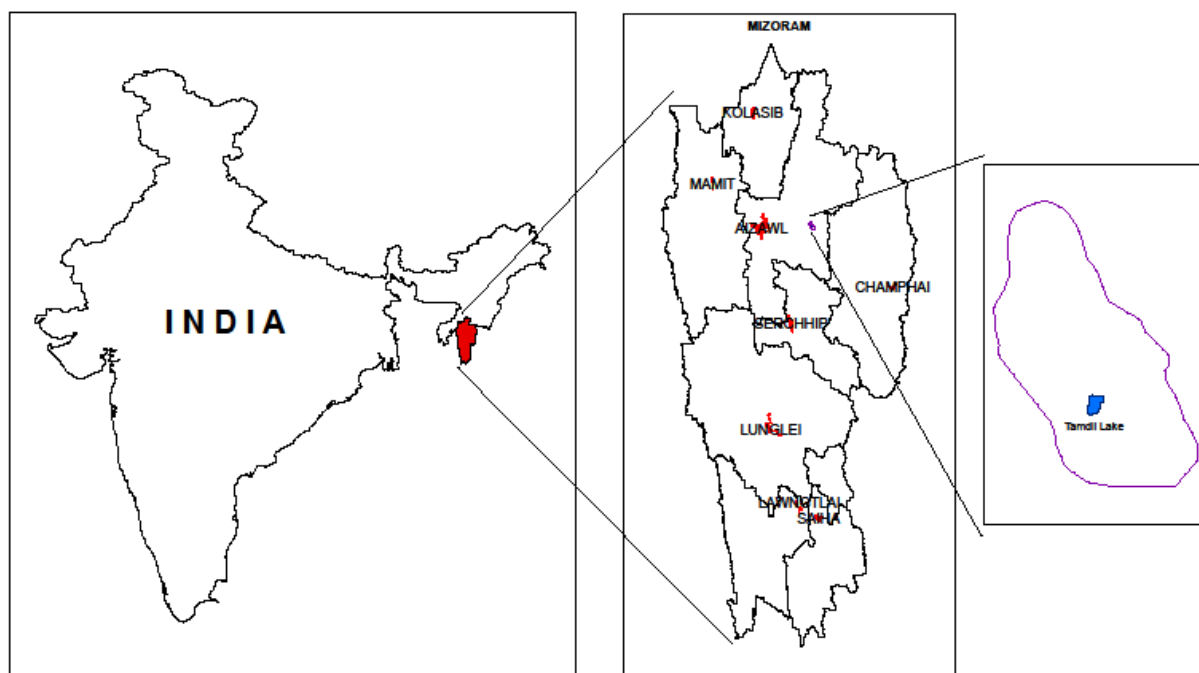
Tamdil, a fresh water lake is located at 12 kms towards the north-west side of Saitual town,

Corresponding author: Chenkual

Phone:

E-mail: chenkualawmi@gmail.com

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Figure 1. Map showing location of study site.



Figure 2. Picture of Tamdil.



Figure 3. Google Earth picture.

Aizawl District, Mizoram. The lake lies between 23°44'20.4"N Latitude and 92°57'10.8'E Longitude. It is situated at an altitude of 717 m above sea level. The circumference of the lake is 890 running meters, with a maximum depth of about 7 meters, it has a catchment area of 13.5 sq km. The lake lies within Aizawl district and is about 110 kms from Aizawl city, the state capital of Mizoram, northeast India. Tamdil is one of the wetlands identified under National Wetland Conservation Programme.

MATERIALS AND METHODS

The water samples of Tamdil were collected from five sampling sites at monthly intervals for analysis of various water quality parameters for a period of one year, i.e. from October 2013 to September 2014.

The selected sampling sites are as follows:

- Site 1 - inflow from Dilkhan village side.
- Site 2 - inflow from Tualbung village side.
- Site 3 - mid-lake region.
- Site 4 - corner of the lake near the outlet.
- Site 5 - outlet of the lake.

The physico-chemical characteristics studied so far are temperature, pH, turbidity, acidity, total alkalinity, total hardness, nitrate-N, phosphate-P, dissolved oxygen and biological oxygen demand. The methods outlined in the Standard methods for the examination of water and waste water⁴ and Handbooks of methods in environmental studies, water and waste water analysis⁵ were used for various physico-chemical attributes. The pH, temperature and DO were analyzed at the sampling sites. Samples for turbidity, acidity, total alkalinity, total hardness, nitrate-N, Phosphate-P and BOD were brought to the Mizoram Pollution Control Board Laboratory for the analysis.

RESULTS AND DISCUSSION

Temperature

The water temperature followed the change

in solar radiation and ambient air temperature. Minimum temperature was found in the winter months (12.5°C, February 2014) and maximum temperature was recorded in summer months (26.3°C, June 2014) Fig 1. The temperature of water is one of the important parameters which directly influences some chemical reactions in water. The findings are in conformity with the work of Mishra *et al.*, 2009⁶ who studied the spring water quality in western part of Aizawl city, Mizoram

pH

pH is a numerical expression that indicates the degree to which water is acidic or alkaline, with the lower pH value tends to make water corrosive and higher pH provides taste complaints and negative impact on skin and eyes⁷. The pH value of the present study ranged between 6.67 to 7.4, which is slightly acidic or alkaline, but more or less neutral pH (Figure 5).

Turbidity

Turbidity is a measurement of the cloudiness of water, measured by passing a beam of light through water. Cloudiness is caused by material suspended in water. Clay, silt, organic matter, plankton and other microscopic organisms cause turbidity in natural water.⁸ The turbidity of Tamdil ranged between 0.22 NTU (February 2014) and 10.4 NTU (July 2014). This maximum turbidity value is beyond the maximum permissible limit prescribed by BIS of 5 NTU⁹ (Figure 6).

Acidity

The acidity of water is its capacity to neutralize hydroxide ions. Acidity may be caused by mineral acids such as sulphuric acid or by hydrochloric acid or by dissolved carbon dioxide. In drinking water, carbon dioxide is the principal cause of acidity. Drinking water with a high acidity is likely to be corrosive to copper water

pipes and to solder which joins those pipes. Since CO₂ is the most likely cause of acidity in the present study, it is observed that the highest value of 10 mg/l was seen during February, and March, 2014 and lowest value of 3.2 mg/l was observed in July 2014 (Figure 7).

Total alkalinity

Alkalinity is a measure of the ability of water to neutralize acids. It is due to the presence of bicarbonate, carbonates and hydroxides of Calcium, Magnesium, Sodium and Potassium. Large amount of alkalinity imparts a bitter taste, harmful for irrigation as it damages soil and hence reduces crop yield.¹⁰ Spence (1996) classified lakes on the basis of alkalinity as 1-15 mg/L as nutrient poor, 16-60 mg/L as moderately nutrient rich and >60 mg/L as Nutrient rich.¹¹ According to this classification, Tamdil falls under nutrient rich during pre-monsoon and post monsoon (Figure 8).

Total hardness

The hardness of water may be due to the presence of carbonates and bicarbonates (temporary hardness) and chlorides and sulphides (permanent hardness) of Ca⁺⁺ and Mg⁺⁺. The total hardness ranged from 23.6 mg/L (September 2013) to 50.4 mg/L (May, 2014) Fig. 9. WHO 2004 classified water on the basis of hardness value in the following manner; 0-75 mg/l soft, 75-150 mg/l medium hard, 150-300 mg/l hard and above 300 mg/l very hard.¹² Tamdil water belongs to soft water.

Nitrate-N

Nitrate concentration in groundwater and surface water is normally low but can reach high levels as a result of agricultural runoff, refuse dump runoffs or contamination with human or animal wastes.¹³ During the present study, the lowest concentration was found in August 2014 as 0.02 mg/L and highest concentration was

recorded in October 2013 as 0.82 mg/l (Figure 10).

Phosphate -P

Phosphate occurs in natural water in low quantity as many aquatic plants absorb and store phosphate in many times their actual immediate needs.¹⁴ Phosphorus is an important element which controls the reproduction and growth of aquatic organisms. The minimum phosphate concentration of 0.02 mg/L was found in November 2013 and maximum concentration of 0.53 mg/l was found in January and March, 2014 (Figure 11).

Dissolved oxygen

Dissolved oxygen in lakes varies according to the tropic levels, and depletion of dissolved oxygen in water probably is the most frequent result of water pollution.¹⁵ As per USPH, the dissolved oxygen should be between 4 and 6 mg/L¹⁶. The dissolved oxygen value in Tamdil ranged between 4.4 mg/L (September 2014) and 7.36 mg/L (February 2014). The value exceeds the limit given by USPH during pre-monsoon months (Figure 12).

Biological oxygen demand

Biological oxygen demand is the amount of oxygen required by bacteria while stabilizing decomposable organic matter under aerobic condition.¹⁷ According to WHO, the BOD of potable water should not exceed 6 mg/L. The BOD value of Tamdil ranged between 0.36 to 1.2 mg/L (Fig.13), which is within the permissible limit.

CONCLUSION

The findings of the present study on various water quality attributes are in conformity with the earlier work done by earlier workers. The results revealed that there was significant varia-

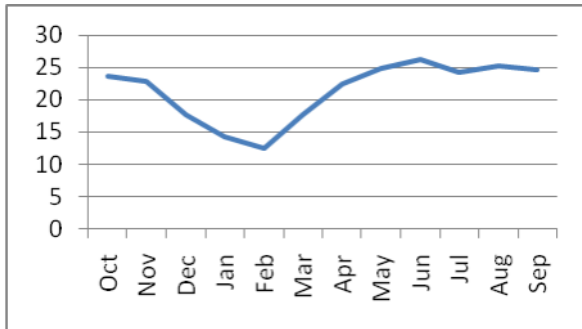


Figure 4. Temperature (°C).

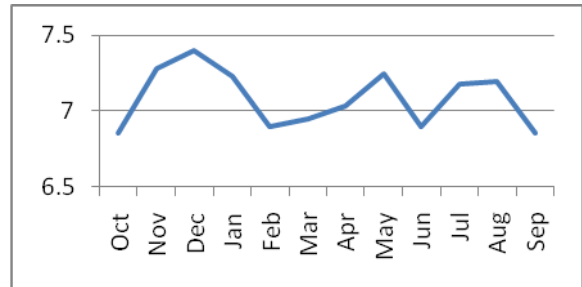


Figure 5. pH.

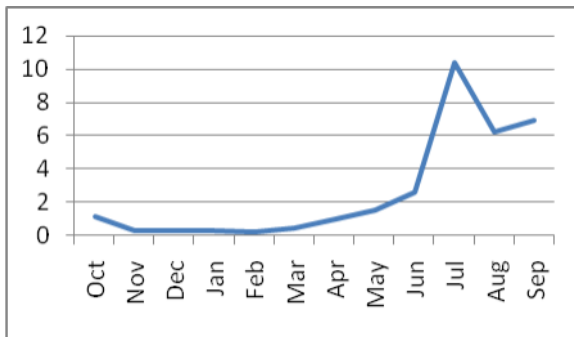


Figure 6. Turbidity (NTU).

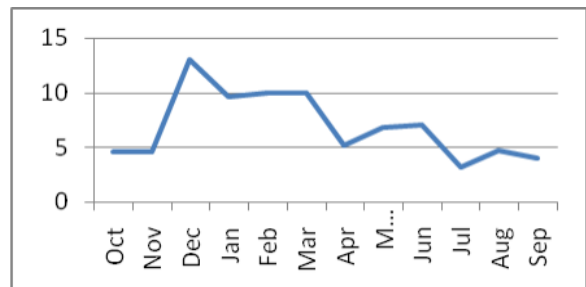


Figure 7. Acidity (mg/l).

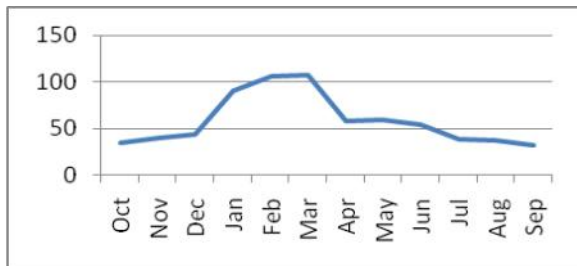


Figure 8. Alkalinity (mg/l).

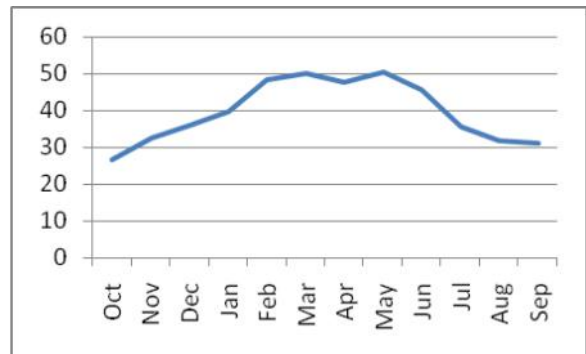


Figure 9. Total Hardness (mg/l).



Figure 10. Nitrate (mg/l).

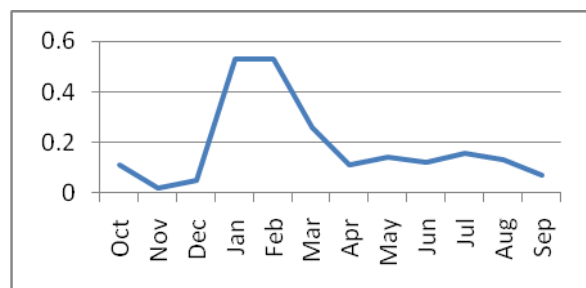


Figure 11. Phosphate (mg/l).

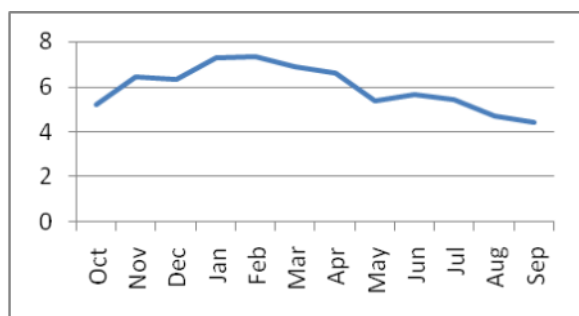


Figure 12. Dissolved oxygen (mg/l).

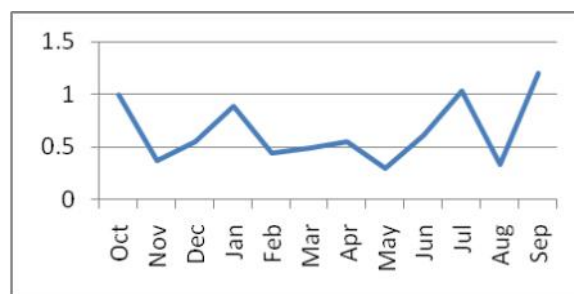


Figure 13. Biological oxygen demand (mg/l).

tion in some physico-chemical parameters and most of the parameters were in the normal range and indicates better quality of the lake. Tamdil is a good, nutrient rich ecosystem and has the ability to sustain tremendous diversity of flora and fauna. The results depict that lake water needs proper management to eliminate traces of pollutants within or above the prescribed limits. This may lead to sustainability at a large.

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