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Research Article

Evaluation of Water Quality in Thadlaskein Lake, West Jaintia Hills, Meghalaya, India

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Abstract: The Thadlaskein Lake is an impoundment Lentic lake located in Mukhla village of West Jaintia Hills, Meghalaya. It is one of a few designated tourist spots of the district. As per the traditional history, the lake was created by Sajar Nangli (a local Chieftain) and his follower using the end of the bows. The present study is an attempt to get a comprehensive idea of the water quality of the lake and its seasonal variations. For assessment of the lake water quality, parameters like pH, EC, TDS, TH, Ca^{2+} , Mg^{2+} , PO_4 , SO_4 , Cl^- and DO were analysed following standard procedures. The data on physico-chemical parameters revealed that water quality of the lake has not yet deteriorated and the measured water quality parameters were found within the permissible limits of Bureau of Indian Standard (BIS). However, there is need for constant vigil to maintain the water quality as the Thadlaskein Lake is attracting large number of tourists in recent past and is under pressure due to various anthropogenic activities occurring in the vicinity of the lake.

Keyword: Water quality, Physico-chemical parameters, Seasonal variations, Thadlaskein Lake, Meghalaya.

INTRODUCTION

Sajar Nangli Lake well known as Thadlaskein Lake is an impoundment Lentic lake located in West Jaintia Hills, Meghalaya. It is situated at an elevation of 1375 msl and lies between $25^{\circ}29'51.5''$ N and $92^{\circ}10'21.8''$ E. The lake is somewhat square in shape. It is surrounded by paddy fields and open pine

forests. The lake is at a distance of about 8 Km from the main town of Jowai and lies along the National Highway No. 44.

According to the traditional history, Sajar Nangli (a local Chieftain) at some point of time had incompatible differences with the King of Jaintiapur. Being human in his thought, he decided to flee from the region with his follower's in order to avoid any bloodbath. However before his departure, he and his followers dug the present day lake with the ends of bows and left the area with this memorial. The people of Mukhla Raid Lake still value the lake and practice rituals and sacrifices till date. In recent years the lake has become one of the most visiting tourist spots of the West Jaintia Hills district (Figure- 1). The prime attraction of the lake is its aesthetic beauty, cool breeze, green surrounding and overall its calm backdrop. All these make the lake a favourite picnic spot. In this study we have analysed various physico-chemical parameters of the water of Thadlaskein Lake keeping in mind to generate baseline data on water quality and also considering different anthropogenic activities occurring in the vicinity of the lake.

EXPERIMENTAL

Water samples from the lake were collected during the pre monsoon (May) and post monsoon (October) period of the year 2013 following standard methods. Grab sampling method was employed for sampling of water. Pre-cleaned plastic bottles were used to collect the samples. *In-situ* measurement of parameters like pH and Electrical Conductivity (EC) was done using EUTECH PCTestr 35. Other parameters such as Total Dissolved Solids (TDS), Total Hardness (TH), Dissolve Oxygen (DO) and levels of Ca^{2+} , Mg^{2+} , PO_4 , SO_4 , Cl^- were estimated in laboratory following standard methods¹⁻³.

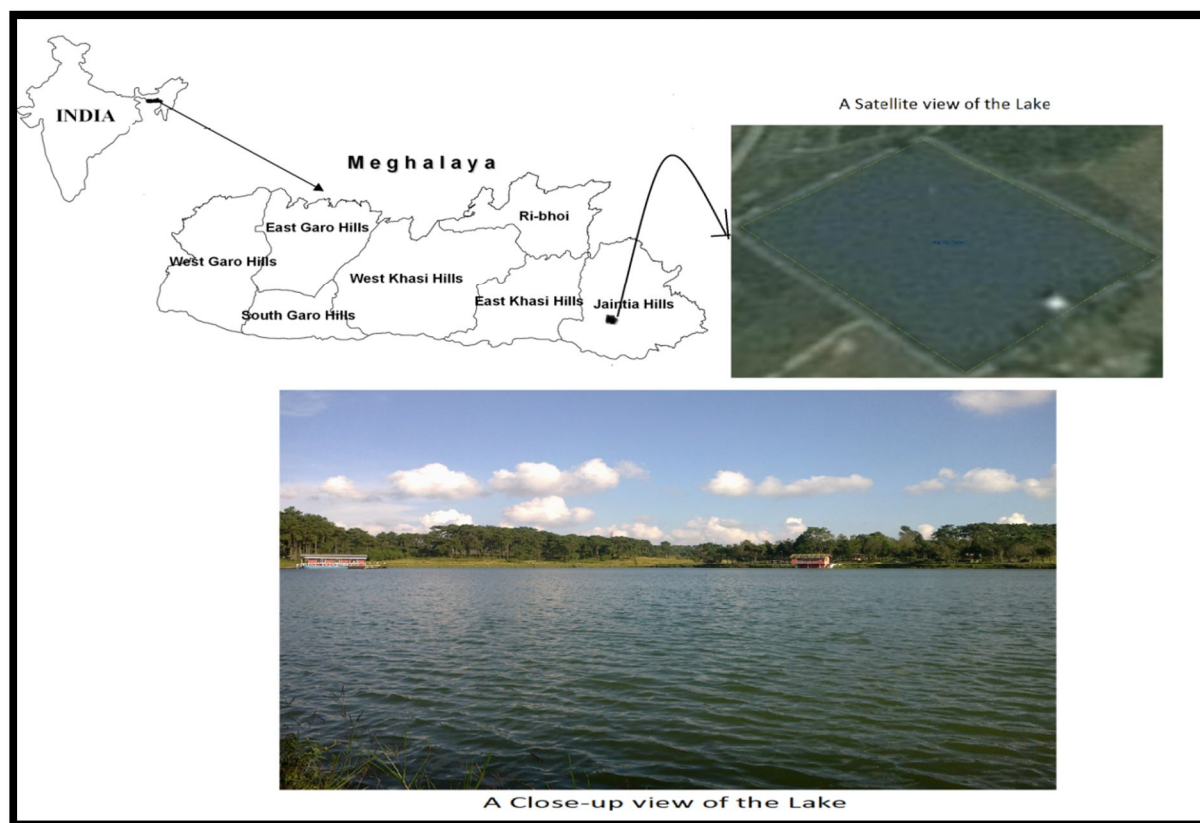


Figure- 1: Figure showing location and a view of the Thadlaskein Lake

RESULTS AND DISCUSSION

Physico-chemical parameters of water samples of Thadlaskein Lake were analyzed in pre monsoon (May) and post monsoon (October) seasons of the year 2013 for understanding the water quality and its seasonal variation. The data is presented in **Table 1** and **Figure 2**.

Table 1: The mean value of different parameters of the Thadlaskein lake water and its comparison with BIS

Parameters	Pre monsoon		Post monsoon		BIS standards IS:10500
	Mean \pm SD	Ranged	Mean \pm SD	Ranged	
pH	6.8 \pm 0.1	6.7-6.9	7.7 \pm 0.1	7.6-7.8	6.5-8.5
EC (μ S)	12.66 \pm 0.57	12-13	11.33 \pm 0.57	11-12	-
TDS (mg/l)	33.33 \pm 5.77	30-40	23.33 \pm 5.77	20-30	500
TH (mg/l)	9.33 \pm 2.3	8-12	21.33 \pm 6.11	16-28	300
Ca ²⁺ (mg/l)	1.96 \pm 0.48	1.68-2.52	3.64 \pm 0.48	3.36-4.2	75
Mg ²⁺ (mg/l)	1.07 \pm 0.26	0.92-1.38	2.96 \pm 1.21	1.84-4.25	30
SO ₄ (mg/l)	49.99 \pm 3.12	46.87-53.12	72.91 \pm 4.77	68.75-78.12	200
PO ₄ (mg/l)	2.32 \pm 0.004	2.3-2.38	2.43 \pm 0.009	2.38-2.54	-
Cl ⁻ (mg/l)	5.99 \pm 0.5	5.49-6.49	8.49 \pm 2	6.49-10.49	250
DO (mg/l)	7.44 \pm 0.4	7.04-7.85	7.38 \pm 0.11	7.24-7.44	-

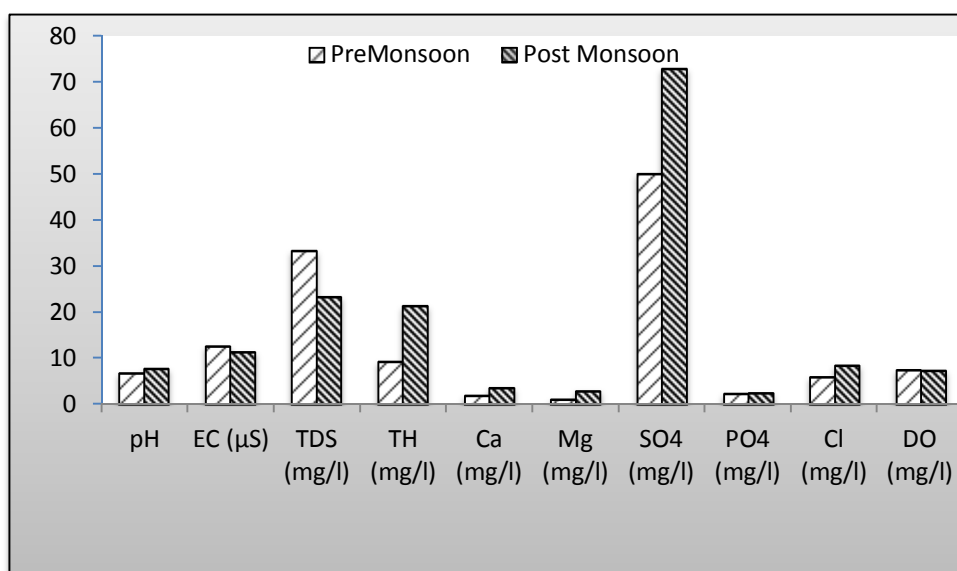


Figure 2: Graphical representation of mean values of different parameters of the Thadlaskein lake water analysed during pre-monsoon and post monsoon seasons.

The study revealed that the pH of the lake water is slightly acidic (mean pH value of 6.8) during the pre-monsoon season and slightly alkaline (mean pH value of 7.7) in post monsoon season. Seasonal variations in pH may be attributed by temperature differences, accumulation of solutes in the form of carbonate/bicarbonates during rainy seasons and respiratory or photosynthesis activities. For both the seasons, overall pH of the lake is in its optimal value. The value of pH falls within the permissible limit of BIS (6.5-8.5). Ionic concentration and dissolved solid content in water determine the electrical conductivity⁴. Low electrical conductivity for both the seasons was observed in the range of a mean value of 12.66 μS (in pre monsoon) and 11.33 μS (in post monsoon) implying that the lake has only a small concentration of dissolved minerals. TDS content in the lake was reported to be higher during pre-monsoon (showing a mean value of 33.33mg/l) while lower content was observed during post monsoon season (showing a mean value of 23.33mg/l). Such a small seasonal variation in TDS, about 10 mg/l, is not significant and could be due to its dilution by the rain water during the monsoon period.

Hardness characteristics of water gave us a general idea of how easy water can form suds with soap, scale formation in water pipes or boilers. The total hardness concentration of the lake is well within the limit set by the BIS (300mg/l). The lake water was found to be soft in nature having hardness mean value of 9.33 mg/l during pre-monsoon and 21.33 mg/l during post monsoon season. Sahni and Yadav⁵ also reported a similar finding. Increasing hardness during post monsoon could be due the presence of calcium, magnesium and sulphate ions. In all type of water, calcium and magnesium are coupled with one another, but concentration of calcium remains generally higher than that of magnesium⁶. Calcium and Magnesium concentrations in the lake for both the seasons are within the permissible limit. Concentration of calcium and magnesium was found slightly higher in the post monsoon season. Generally, chloride concentration in natural surface water is very low. The mean values for chloride concentration during pre-monsoon and post monsoon seasons detected were 5.99mg/l and 8.49 mg/l, respectively. The chloride concentration in the lake falls within the permissible limit (BIS: 250 mg/l) indicating absence of chloride contamination sources in the vicinity of the lake.

Sulphate is found in most water bodies. But concentration beyond 200mg/l is unsuitable for drinking purposes. Sulphate content of the lake was found within the permissible limits of BIS. The sulphate ions concentration in pre monsoon was minimum and having a mean value of 49.99 mg/l and maximum with mean value of 72.91 mg/l in post monsoon. Insignificant seasonal variation in phosphate ions concentration was observed during the study period. Phosphate ion concentration was at the lowest order having mean values of 2.32 mg/l during pre-monsoon and 2.43 mg/l during post monsoon seasons. This may due to low level of decomposing organic matter and human interference. Concentration of dissolve oxygen of any water body plays an important role in determining the water quality. Higher the dissolve oxygen content of the water better is the water quality of the area apart from shallow water. The DO values of the lake changes only slightly from pre monsoon to post monsoon having mean value of 7.44mg/l and 7.38mg/l, respectively. This desirable concentration of DO may due to the low organic material content in the lake.

Several studies on quality of lake water have been carried out in past by different researchers. Results reported from analysis of water quality of Saathamcottah Lake⁷, Chandola Lake⁸, Ullal Lake⁹, Malav Lake¹⁰, Periyar Lake¹¹ and lakes in and around Coimbatore¹² described that these lakes were poor in water quality/polluted, biologically inactive in nature or unfit for human consumptions and highly eutrophic in its nature. The degradation in water quality were mainly due to different anthropogenic activities ranging

from domestic/agriculture waste disposal, developmental activities and disturbances in the nearby catchment areas and influx of untreated effluent from the vicinity of the lakes. In contrast to these results, the water quality of Thadlaskein Lake was found in good condition and the lake is not yet affected by various activities taking place around the area. This may be due to the least human interferences in its vicinity. Akindele¹³ also reported that less impact will be on the lake if it is away from anthropogenic activities. So far the settlements and commercial activities are located fairly at a distance from the lake. However, some construction works have already started near the lake, which if not properly planned may pose threat to the water quality of the lake. It is reported that the surface water in Jaintia Hills, Meghalaya has been severely affected by coal mining. The water of several streams and rivers has become highly acidic and contaminated with sulphate, iron and other ions due to contamination with acid mine drainage (AMD) emanating from active and abandoned coal mines^{14, 15}. Thus, Thadlaskein Lake seems to be highly vulnerable to various types of contamination and therefore needs special attention.

CONCLUSION

Taking into account the results of physico-chemical parameters of lake water, the findings clearly signify that the lake is not yet deteriorated or polluted and has good water characteristics and no major seasonal variations occur in its water quality. All parameters investigated were within the permissible limits set by the BIS. As a result, the lake water characteristics can be regarded as still in a very good condition. However, there is a need to maintain the water quality by adapting good practices. The tourists and people of the surrounding areas are advised not to hamper the lake by throwing or disposing garbage/sewage waste in its vicinity. Villagers should be discouraged to use agrochemicals, as in long run this will pose a serious threat to the lake. Further, good forest cover and greenery should be maintained in order to sustain the quality and quantity of the lake water. Based on this study, the lake may be categorized as an oligotrophic lake.

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