

Evaluation of the Seasonal Physicochemical Changes in Manjakkudi and Pakkam lakes, TN, India

Benila smily, J. M and Sumithra, P.

Department of Microbiology, Srimad Andavan college of Arts and Science Thiruchirappalli-620 005, Tamil Nadu, India.

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ABSTRACT

There is the necessity to preserve the water resources which gets polluted everyday due the development of urbanization. We should acquire the knowledge of nature and level of pollution for choosing the effective remediation techniques. In the present study, the water quality and nutritional characteristics in two freshwater ecosystems, Manjakkudi and Pakkam lakes were investigated simultaneously every month over a two-year period (March 2013 - February 2015). The physicochemical characterization results revealed that there is a strong correlation between the seasonal variation and the physicochemical variations. There is a monthly fluctuation in the physicochemical parameters of both the lakes which was reflected by the variation in the supply of nutrients. In conclusion, the observations of the present investigations enunciate that the seasonal variations and human activities, both plays a great role in the water quality in Manjakkudi and Pakkam lakes.

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Introduction

Water is an essential for all the activities including drinking, power generation, irrigation, etc. (Sathe *et al.*, 2001). Of the total water available on earth, only 0.3 – 0.5% are only freshwater that fits for consumption. At present scenario, the increased urbanization and industrialization led us to use the chemicals that pollutes the natural resources including water bodies which in turn deteriorate the quality of water and aquatic life. The knowledge of water chemistry is essential to gain the knowledge about the ecosystem (Deshmukh and Ambore, 2006).

The various life forms in freshwater ecosystem is affected by the variations in the physico-chemical parameters (Jewel *et al.*, 2003) the variations in the physicochemical properties in the freshwater ecosystems is greatly influenced by human activities (Kund-Hansen and Batterson, 1994) and by seasonal variation (Skejic' *et al.*, 2011). Manjakkudi and Pakkam lakes are the two freshwater ecosystem in the Pudukkottai district of Tamil Nadu, India. These two lakes serves as the drinking water resource for the nearest villages. The understanding of the physico chemical dynamics in such freshwater ecosystems may contribute to gain a clear picture of the hydro biological features and ecological interactions in these two ecosystems (Muangkeow *et al.*, 2011). Against these points, the present study aimed to document the major physico-chemical parameters and characterize the biological environment of the selected two freshwater ecosystems and to determine the role of seasonal variations in those parameters.

Materials and Methods

Site description

The investigated freshwater ecosystems were Manjakkudi and Pakkam lakes area lies at Pudukkottai district of Tamil Nadu state, India. The climate of the region is extremely arid and hot with high maximum temperature that may reach or sometimes exceed 40 °C in summer. These lakes were served as drinking water resource for the nearby villages.

Sampling

Water samples were collected on first Sunday of every month throughout the study period during morning 7.00 AM to 9.00 AM from the selected sites using sterilized wide mouth Polyethylene bottle. For measuring dissolved oxygen, the water samples were collected in a separate 500 ml BOD glass bottle with glass stopper and the lid is closed carefully without bubbles formation.

Sample analysis

Water temperatures were determined *in situ* with an ordinary glass mercury thermometer calibrated to tens of a degree centigrade. pH measurements were carried out in the field with a glass electrode pH meter. Electrical conductivity and salinity were measured using an conductivity meter. Levels of dissolved oxygen were determined by unmodified Winkler titration method (APHA, 1985). Dissolved oxygen fixation was done in the field in BOD (biological oxygen demand) bottles. Acidification and titration were accomplished at the laboratory (Rajeev Shripad Hardikar, 2013).

Data analyses

Data were analyzed by descriptive statistics (averages and standard deviations).

Results and Discussion

The present study was carried out to determine the role of seasonal variation in the physicochemical parameters in Manjakkudi and Pakkam Lakes. Jayaraman *et al.*, (2003) described that the temperature plays crucial role in the biological and chemical activities in water. The water temperature depends on the fluctuations in air temperature which is found to be minimum in winter and maximum in summer (Koorosh Jalilzadeh *et al.*, 2009). Both the freshwater ecosystems abide the above fact and may also depend on the duration of the day time.

The difference in the temperature is one of the major abiotic factors determining the fluctuations in other physico-chemical and biotic factors (Hecky, 2000; Arfi *et al.*, 2001; Khan *et al.*, 2012).

While characterizing pH of the two ecosystems, both of the lakes were alkaline in nature. With respect to pH, no significant variation was observed with respect to seasonal variations. The values recorded in the Pakkam lake were typically alkaline and generally higher than those of Manjakkudi Lake in which pH remained near neutral to mildly alkaline. In both the lakes, during the month of October, pH was found to be more alkaline when compared to other months. The variation in pH in the same water body is the indicative of the presence of certain effluents (Sunilkumar, 1998). Verma *et al.*, (1978) and Sharma *et al.*, (1986) also claimed that most of the Indian freshwater bodies are found to be alkaline in nature.

Dissolved oxygen is important for the survival of the aquatic organisms. The dissolved oxygen of the aquatic system was determined by the temperature and turbidity of the water bodies (Vasumathi Reddy *et al.*, 2009). The level of the dissolved oxygen was also determined in both the lakes during the study period. In both the lakes, during the month of November, there observed the increased levels of dissolved concentration. The Elevated levels of dissolved oxygen in both the lakes might be due to then result of activities of phytoplankton (Kotut *et al.*, 1998). Patil Anil (2009) also made similar observations when analyzing the physicochemical variables of Indian freshwater ecosystems.

Electrical Conductivity is an indicative of the concentration of the total amount of dissolved salts in water. The salt dissolved in the water liberates charged ions which conduct electricity and hence determines the electrical conductivity of the water. Generally hard water is the term indicates the water contains high amount of dissolved salts which possess greater electrical conductivity. The electrical conductivity was found to be high in case of Manjakkudi Lake, when compared to Pakkam Lake. In particular, during the months of winter, electrical conductivity was more in both the lakes. The determination of electrical conductivity was important, which was indirectly influenced by the CO₂ utilization *via* the photosynthesis of phytoplanktons (Salmaso and Decet, 1998).

The increase and decrease in the levels of selected variables could be possibly due to the additions of fertilizers, manures and the fish excreta released into the water. Further investigations are necessary for the management of both lakes for their multiple usage and to ensure healthy freshwater ecosystem. Hence, there should be a suitable management and permanent monitoring system for maintaining the quality of the freshwater ecosystems.

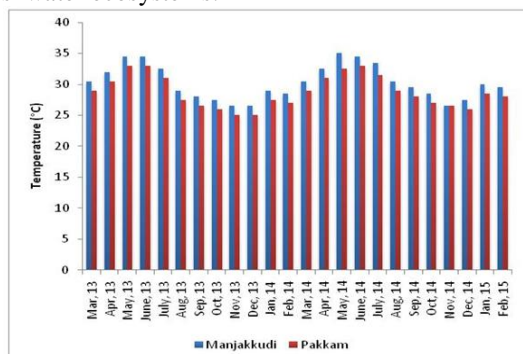


Fig 1. Variation of Temperature in Manjakkudi and Pakkam lakes in different seasons.

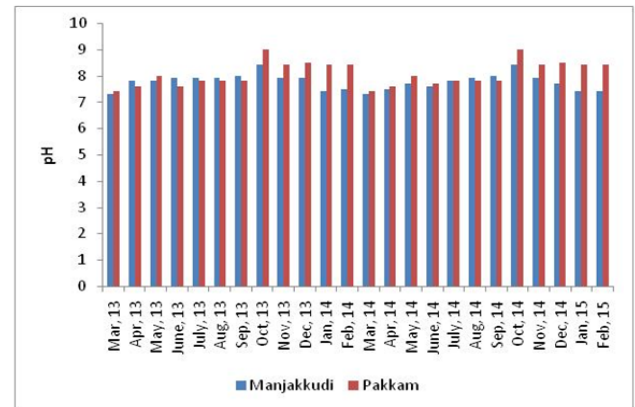


Fig 2. Variation of pH in Manjakkudi and Pakkam lakes in different seasons.

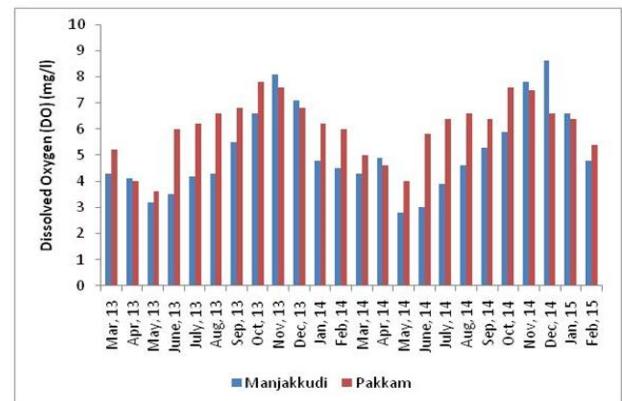


Fig 3. Variation of dissolved oxygen in Manjakkudi and Pakkam lakes in different seasons.

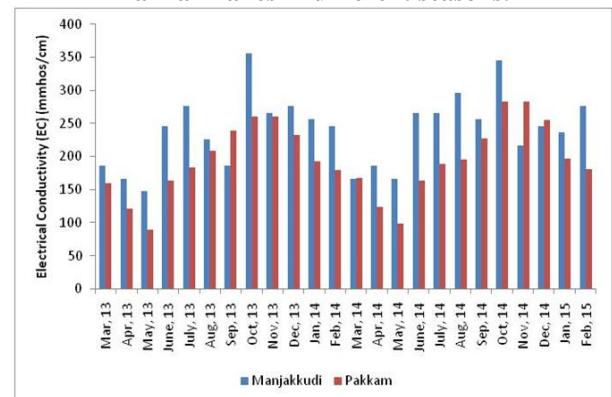


Fig 4. Variation of Electrical Conductivity in Manjakkudi and Pakkam lakes in different seasons.

Conclusion

In the present study, the water quality assessment of selected parameters was analyzed every month in two freshwater ecosystems, Manjakkudi and Pakkam lakes. The present study concluded that there is a strong correlation between the changes in the seasons and the physicochemical parameters of the selected two different lakes. The discharge of domestic and industrial effluents also plays a critical role in these variations. Effective management of the selected freshwater ecosystem is required to minimize the problems associated to human health.

References

- American Public Health Association (APHA), 1985 American Public Health Association (APHA) Standard methods for the examination of water and wastewater (16th ed) APHA, Washington, DC, USA (1985)
- Arfi R, Bouvy M, Cecchi P, Pagnao M, Thomas S, 2001. Factors limiting phytoplankton productivity in 49 shallow

- reservoirs of North Côte d'Ivoire (West Africa). *Aquat. Ecosyst. Health* 4:123-138.
3. Deshmukh J .U. and Ambore N. E. (2006). Seasonal variations in physical aspects of pollution in Godavari river at Nanded, Maharashtra, India. *J Aqua Biol.* 21(2) : 93-96
4. Hecky, R.E. A biogeochemical comparison of Lake Superior and Malawi and the limnological consequences of an endless summer *Aquat Ecosyst Health Manag*, 3 (2000), pp. 23–33
5. Jayaraman PR, Ganga DT, Vasudevan NT., (2003), *Water Quality Studies on Karamana River, Thiruvananthapuram District, South Kerala, India, Pollution research*, 22(1), pp 89-100.
6. Jewel, M. A. S., Affan, M. A. & Khan, S. 2003. Fish mortality due to cyanobacterial bloom in an aquaculture pond in Bangladesh. *Pakistan J. Biol. Sci.* 6 (12): 1046-1050.
7. Khan, R.M., M.J. Jadhav, I.R. Ustad Physical analysis of Triveni Lake water of Amravati district in [MS] *India Biosci Discov*, 3 (2012), pp. 64–66
8. Kotut, K., L. Krienitz, M.M. Muthuri Temporal changes in phytoplankton structure and composition at Turkwel Gorge Reservoir, Kenya *Hydrobiologia*, 368 (1998), pp. 41–59
9. Kund-Hansen, C.F., T.R. Batterson Effect of fertilization frequency on the production of Nile tilapia (*Oreochromis niloticus*) *Aquaculture*, 123 (1994), pp. 271–280
10. Muangkeow, B., K. Ikejima, S. Powtongsook, W. Gallardo Growth and nutrient conversion of white shrimp *Litopenaeus vannamei* (Boone) and Nile tilapia *Oreochromis niloticus* L. in an integrated closed recirculating system *Aquaculture Research*, 42 (2011), pp. 1246–1260
11. Patil, Anil R. and Lohar Prakash S.(2009): "Seasonal variations in physic-chemical parameters of river Patalganga, Raigad district, Maharashtra", *J. Aqua. Biol.*, 24(2):1- 4
12. Rajeev Shripad Hardikar, 2013. Limnological studies of selected ponds of Ahmedabad with reference to physico-chemical properties and plankton. A Ph.D. thesis submitted to the Shri Jagdish Prasad Jhabarmal Tibrewala University, Vidyanagari, Jhunjhunu, Rajasthan.
13. SALMASO, N. AND F. DECET. 1998. Interactions of physical, chemical and biological processes affecting the seasonality of mineral composition and nutrient cycling in the water column of a deep subalpine lake (Lake Garda, Northern Italy). *Arch. Hydrobiol.* 142: 385–414.
14. Sathe, S.S., Suresh Khabade and Milind Hujare "Hydrobiological studies on two man made reservoirs from Tasgaon Tahsil (Maharashtra) India", *Ecol. Env. And Cons.* 7(2), p. 211-217, 2001.
15. Sharma V K., (1986), Ph.D thesis, Punjab University, Chandigarh.
16. Skejić, S., I. Marrasović, O. Vidjak, G. Kušpilić, N.G. Zivana, S. Stefanija, et al. Effects of cage fish farming on phytoplankton community structure, biomass and primary production in an aquaculture area in the middle Adriatic Sea *Aquaculture Research*, 42 (2011), pp. 1393–1405
17. Sunilkumar and Ravindranath, (1998). *Water studies Methods Monitoring Water Quality*, Centre for Environmental Education (CEE), Ahmedabad.
18. Vasumathi Reddy, K., Laxmi Prasad, K., Swamy, M. and Ravinder Reddy 2009. Physico-chemical parameters of Pakhal Lake of Warangal district, Andhra Pradesh, India. *J.Aqua.Biol.*, 24 (1): 77-80.
19. Verma, S. K., Mohindroo, S. R. and Kansal, D. K., 1978 "Factors limiting performance of football players on cycle ergometer." *J.Sports Med.& Phys.Fit.* 18: 43-47.