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AN ANALYSIS OF PHYSICO-CHEMICAL VARIABLES OF WATER IN LOWER ANICUT, THANJAVUR DISTRICT, TAMIL NADU

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ABSTRACT

During the last few years, the water quality of most Indian aquatic systems has been deteriorating because of increased anthropogenic activity organisms especially phytoplankton which are the producers of aquatic systems depend directly on the physicochemical variables of water. Hence, physicochemical variables play an important role in the composition and diversity of aquatic organism. Hence, the present study was attempted at Lower Anicut at Anakkarai area in Thanjavur District, Tamil Nadu. Various physicochemical variables have been analyzed on a seasonal basis and the results interpreted with those of similar workers.

KEY WORDS

Physicochemical variables, River, Total bacterial density, Coliform count

INTRODUCTION

Though water is a renewable resource, reckless usage and improper management of water systems can cause serious problems in availability and quality of water (Raja *et al*., 2008). During the last few years, the water quality of most Indian aquatic systems including rivers have been subjected to severe anthropogenic activity leading to vast deterioration of the water quality (Sivakumar *et al*., 2000; Krishnan *et al*., 2007; Gholami *et al.*, 2010; Rajamanickam and Nagan, 2016). Further, the development of phytoplankton in a river depends directly upon the physical factors of flow and turbidity. In addition, day length and temperature also seem to be important (Annalakshmi and Amsath, 2012). Many authors (Eggs and Aksnes, 1992; Anjana and Kanhera, 1998; Chellappa *et al*., 2008) have suggested that nutrient availability also plays a significant role in algal production. Hence, physico-chemical variables play an important role in the composition as well as diversity of an aquatic system. Hence, the present study was aimed at assessing the physico-chemical variables of Lower Anaicut of Anakkarai area in Thanjavur district, Tamil Nadu for three seasons of the year.

MATERIALS AND METHODS

The Lower Anicut is located at Anakkarai, Thanjavur District, Tamil Nadu, India (Latitude: 10.95, and the Longitude: 79.38). Water samples from Lower Anicut were collected during the three different seasons of the year (2017-18). Water samples were collected from this system in a polyproplene cans (2 liters capacity) and transported to the laboratory. pH of the water samples was measured using a digital pH meter. The various variables like Total Dissolved Solids (TDS), alkalinity, Dissolved Oxygen, BOD, COD and nutrients like NO_3-N, NO_2-N, PO_4-P, NH_3-N, Silicate, Calcium, Magnesium and Sodium were estimated by following the methods in APHA (2005) and Trivedi and Goel (1986). To determine the total heterotrophic bacterial density, total coliform bacteria and total fecal coliform bacterial density, the water samples were collected in sterile plastic bags and immediately transported to the laboratory. The total bacterial count was enumerated as colony forming unit (CFU) employing the standard pour plate technique following the methods described in APHA (2005) and Cruickshank *et al*. (1975). Plate count nutrient agar medium was used for enumeration purposes. The agar was autoclaved prior to use. After 24 hours of incubation, colony counts were made using a colony counter and expressed as cfu/ml^{-1}.

RESULTS AND DISCUSSION

The various physico-chemical variables analysed in the system are presented in Table-1. As evident from the table, the surface water temperature was found to range from 26 to 33°C for the three seasons showing an annual variation of 7°C. The minimum was noticed in the rainy season (August-November) and the maximum in the summer season (May-July). Water temperature plays a major role in the biology and distribution of organisms. According to Jhingran (1991), fishes especially carps thrive well in temperature range of 18.3–37.3°C. pH on the other hand was found to vary from 7.8 to 8.4 with an overall range of 0.6 units. Again, the minimum was noticed during the rainy season and the maximum during the summer season. The high pH levels noticed during the summer season can be attributed to high photosynthetic activity resulting in increased production of CO_2 shifting the equilibrium towards the alkaline side as opined by Saxena and Saksena (2012).

Table-1: Seasonal variation of physio-chemical variables of water at Lower Anicut

S.No.	Parameters	Unit	Rainy Season (Aug-Nov)	Pre-Summer (Dec-Mar)	Summer Season (Apr-Jul)
1.	Atmospheric Temperature	°C	29 ± 0.72	31 ± 0.54	38 ± 0.32
2.	Water Temperature	°C	26 ± 0.64	28 ± 0.54	33 ± 0.24
3.	pH		7.8 ± 0.42	8.0 ± 0.78	8.4 ± 0.52
3.	Transparency	cm	12 ± 0.56	35.0 ± 0.98	46 ± 0.92
4.	Dissolved Oxygen	mg/l	7.8 ± 1.6	6.6 ± 0.88	5.4 ± 0.46
5.	Free CO_2	mg/l	0.5 ± 1.2	0.65 ± 0.80	0.82 ± 0.92
6.	Total Alkalinity (MOA)	mg/l	14.0 ± 2.6	160 ± 0.42	210 ± 0.56
7.	Total Dissolved Solids (TDS)	mg/l	196 ± 1.6	230 ± 0.56	270 ± 0.32

Dissolved oxygen in the system was found to vary from 5.4 (Summer) to 7.8 mg/l (rainy season) with an overall range of 2.4 mg/l. On the other hand, free CO_2 was found to range from 0.5 (rainy season) to 0.82 mg/l (summer season) with an overall range of 0.32 mg/l. Thus, there was an inverse relationship between them. Hutchinson (1957) also reported higher DO in winter/rainy season and lowest amount in summer season. He attributed this to the ability of water to hold more dissolved gases in low temperature. The lower DO content noticed in summer could be due to the result of increased decomposition as suggested by Wetzel (1983). The higher levels of free CO_2 noticed during the summer season could be due to increased decomposition of organic matter and low precipitation of free CO_2 as carbonates (Mugilan, 2014).

The methyl orange alkalinity of the system was found to range between 14 (rainy season) and 21 mg/l (Summer season) with an overall range of 7 mg/ml. Literature reveals that water in tropical plains with low rainfall during summer have high alkalinity values (Young *et al*., 1972; Sivakami *et al*., 2011; Sankar rao, 2013; Mugilan, 2014). Further, the high alkalinity levels noticed in summer may be due to increased rate of organic decomposition during which free CO_2 is liberated which reacts with water to form bicarbonates resulting in increased alkalinity (Goel and Trivedi, 1984).

The total dissolved solids were found to vary from 196 to 270 mg/l with the minimal levels noticed in rainy and the maximum levels in the summer season. According to Santharam (1979), the variation in TDS can be attributed to the age of the system in addition to the materials being washed into the system.

The various nutrients analysed in the system are presented in Table-2. The level of phosphate in the system varied between 1.2 to 176 mg/l with an overall variation of 0.56 mg/l. The minimal levels were recorded in the rainy season. The same trend appeared to be true for silicate levels also. The effect of rainfall increasing the nutrient content has been recorded by a number of workers (Kaushik and Saxena, 1994; Garg *et al.*, 2009; Sankarrao, 2013; Mugilan, 2014).

Table-2:Seasonal variation of nutrient and bacterial load of water at Lower Anicut

S. No.	Parameters	Unit	Rainy Season (Aug-Nov)	Pre-Summer (Dec-Mar)	Summer Season (Apr-Jul)
1.	Phosphate (PO_4-P)	mg/l	1.76 ± 4.0	1.20 ± 0.32	1.4 ± 0.64
2.	Silicate (SiO_2-Si)	mg/l	6.8 ± 0.64	4.7 ± 0.35	5.6 ± 0.52
3.	Nitrate-N (NO_3-N)	mg/l	2.8 ± 0.72	2.0 ± 0.38	1.8 ± 0.56
4.	Nitrite-N (NO_3-N)	mg/l	0.42 ± 0.79	0.76 ± 0.42	0.94 ± 0.52
5.	Ammonia-N (NH_3-N)	mg/l	0.48 ± 0.92	0.56 ± 0.72	0.67 ± 0.64
6.	Calcium (CO_3)	mg/l	82 ± 0.70	02 ± 0.94	99 ± 0.7
7.	Magnesium (Mg)	mg/l	34 ± 0.66	36 ± 0.98	38 ± 0.64
8.	Sulphate (SO_4)	mg/l	7.6 ± 0.37	8.2 ± 0.83	9.8 ± 0.24
9.	Chloride (Cl_2)	mg/l	140 ± 0.42	156 ± 0.80	160 ± 0.46
10.	Sodium (Na)	mg/l	180 ± 0.46	192 ± 0.72	210 ± 0.52
11.	Biological Oxgen Demand	mg/l	7.2 ± 0.34	8.4 ± 0.46	9.4 ± 0.56
12.	Chemical Oxygen Demand	mg/l	47.8 ± 0.56	49.4 ± 0.94	52 ± 0.62
13.	Total Bacterial Density	/100 ml	$8.6\times10^3\pm0.62$	$7.4\times10^3\pm0.52$	$8.1\times10^5\pm0.84$
14.	Total Coliforms Count	/100 ml	280 ± 0.53	142.3 ± 0.64	167.7 ± 0.26
15.	Fecal Streptococci	/100 ml	185 ± 0.42	96.4 ± 0.62	103.0 ± 0.80

A comparison of other nutrients like NO_2-N, SO_4, Ca, Mg, Cl and Na reveals that the minimum levels were recorded in the rainy season and the maximum levels in the summer season. While the minimum levels of these nutrients noticed during the rainy seasons could be attributed to the increased water level bringing about dilution of the nutrients, the maximum level noticed in the summer season could be attributed to their utilization in addition to decrease in water level leading to increase in the concentration of these nutrients. On the other hand, NO_3-N and NH_3-N recorded minimal levels in summer season and maximum levels in the rainy season. The maximum levels noticed in rainy season can be attributed to their autochthonous entry brought about by runoff water, in addition to entry of fertilizers from the nearby fields. Similar results have been reported by Reid (1961), Rajalakshmi (1980), Kastooribai (1991) and Mugilan (2014).

The BOD levels in the system was found to range between 7.2 to 9.4 mg/l with an overall variation of 2.2 mg/l while the COD levels ranged between 47.8 to 52 mg/l with a variation of 4.2 mg/l, while both BOD and COD recorded minimal levels in the rainy season, the maximum was recorded during the summer season. The high levels of BOD noticed during the summer season clearly suggest increased decomposition which resulted in a decrease of oxygen. In conjunction with the BOD test, the COD test is useful in indicating the toxic condition and presence of biologically resistant organic substances (Sarmaand Elias-Gutierrez, 1988; Sivakami*et al.*, 2011; Prabhakaret *al.*, 2012).

The total bacterial density (TBD) was found to range between 7.4×10^{-3} (pre-summer season) to 8.6×10^{-3}cfu/ml^{-1} (rainy season). The maximum TBD noticed during the rainy season can be attributed to the inflow of surface run off entering the system bringing along with-it enough nutrients required for the growth of the organisms while the minimum noticed during the pre-summer season may be due to lower water temperature and inadequate nutrients (Kumar and Saha, 2009; Shimna, 2012).

The total coliform count varied between 142.3 to 280 cfu/ml^{-1}and fecal streptococci from 96.4 to 185 cfu/ml^{-1}. Both these variables recorded minimal levels in the pre-summer season and the maximal levels in the rainy season. The maximum levels noticed in the rainy season can be attributed to the influx of water entering the system enriching it with nutrients. Shimna (2012) and Sankarrao (2013) while studying two fresh water systems in Tamil Nadu also reported maximal occurrence during the rainy season.

REFERENCES

Anjana, S. G. and Kanhere, R.R. (1998). Seasonal dynamics of phytoplankton population in relation to abiotic factors of a fresh water pond at Barwani (M.P.). *Poll. Res*.,17:133-136.

Annalakshmi, G. and Amsath, A. (2012): Studies on the hydrobiology of river Cauvery and its tirbutaries Arasalar from Kumbakonam region (Tamil Nadu, India) with reference to phytoplankton. *International Journal of Plant, Animal and Environmental Sciences*, 2: 37-46.

APHA (2005). Standard methods for the examination of water and waste water analysis. 21st Edn., Washigton DC.

Chellappa, N.T., Borba, J.M. and Rocha, O. (2008). Phytoplankton community and physicalchemical characteristics of water in the public reservoir of Cruzeta, RN, Brazil. *Braz. J. Biol*., 68, 477-494.

Cruickshank, R., Duguid, J.P., Marmion, B.P. and Swain, R.H.A. (1975). *Medical microbiology: The practice of medical microbiology* 12th Ed., Vol.2. Churchill Livingstone, Edinburg, London and New York

Eggs, J.K. and Aksnes, D.L. (1992). Silicate as regulating nutrient in phytoplankton competition. *Mar. Ecol. Proc. Ser.*, 83: 281-289.

Garg, R. K., Rao, R. J. and Saksena, D. N. (2009). Water quality and conservation management of Ramasagar reservoir, Datia, Madhya Pradesh. *J. Environ. Biol.,* 30: 909-916.

Gholami, S., Srikantaswamy, S., Shakuntala Bai and Raghunath, T. (2010). Seasonal water quality index of Cauvery River around KRS dam, Karnataka, India. IJCEES, 1: 10-21.

Goel, P. K. and Trivedi, R. K. (1984). *Chemical and Biological methods for water pollution studies*. Karad Environmental publication, pp. 1-251.

Hutchinson, G. E. (1957). A treatise on limnology, Vol. I. *Geography, Physics and Chemistry*. John Willey and Sons, Inc. New York 1015.

Jhingran, V. G. (1991). *Fish and Fisheries of India*. 2nd ed. Hindustan Publishing Corporation, New Delhi.

Kastooribai, R. S. (1991). A comparative study of two tropical lentic systems in the context of aquaculture. Ph. D. Thesis, University of Madras, India.

Kaushik, S. and Saksena, D. N. (1994). The tropic status and habitat ecology of entomofauna of the water goodies at Gwalior, Madhya Pradesh. In: Perspective in Entomological Research (Ed. Agarwal, O. P.), Scientific Publishers, Jodhpur.pp. 241-261.

Krishnan, R. R., Dharmaraj, K. and Ranjitha Kumari, B. D. (2007). A comparative study on the physico-chemical and bacterial analysis of drinking, borewell and sewage water in the three different places of Sivakasi. *J. Environ. Biol*., 28: 105-108.

Kumar, S. and Saha, L. L. (2009). Incidence of indicator bacteria in different drinking water sources. In: Assessment of water pollution (Ed. S. R. Mishra). A. P. H. Publishing Corporation, New Delhi.

Mugilan, V. (2014). Biodiversity of microorganisms in two different fresh water ecosystems and their role in environmental pollution abatement. Ph.D. Thesis, Bharathidasan University, Tiruchirappalli.

Prabhakar, C., Saleshrani, K. and Tharmaraj, K. (2012). Seasonal variation in Physico-chemical parameters of Palar River in and around Vaniyambadi Segment, Vellore District, Tamil Nadu, India. *Int. J. Pharm. and Biol. Arch.* 3: 99-104.

Raja, P., Muhindhar Amarnath, A., Elangovan, R. and Palanivel, M. (2008). Evaluation of physical and chemical parameters of river Kaveri, Tiruchirappalli, Tamil Nadu, India. *Journal of Environmental Biology*, 29: 765-768.

Rajalakshmi, R. T. (1980). Limnological studies of Gangadhareswarar temple tank in Madras. M.Phil. Dissertation, University of Madras, India.

Rajamanickam, R. and Nagan, S. (2016). Common biomedical waste treatment facility - A performance Study. *Indian Journal of Environmental Protection*, 36: 364-372.

Reid, G. K. (1961). *Ecology of inland waters and estuaries*. New York, Reinhold. p. 375.

Sankararao, M. (2013). A study on seasonal variations of microorganisms in temple ponds and its role in antimicrobial activity. Ph.D. Thesis, Bharathidasan University,Tiruchirappalli.

Santharam, K. R. (1979). Biology of *Daphnia carinata* king. Ph.D. Thesis. Madurai Kamaraj University, India.

Sarma, S. S. S. and Elias-Gutierrez, M. (1988). Rotifers from four natural bodies of central Mexico, *Limnologica*, 29: 475-483.

Saxena, M. and Saksena, D. N. (2012). Water quality and trophic status of Raipur reservoir in Gwalior, Madhya Pradesh. *Journal of Natural Sciences Research,* 2: 82-96.

Shimna, P. P. (2012). Microbial diversity and abundance of ponds of subtropical India. Ph.D. Thesis, Bharathidasan University, Tiruchirappalli, India.

Sivakami, R., Sankarrao, M., Shimna, P. and Premkishore, G. (2011). Rotifer population in two freshwater bodies with varied water sources in Tiruchirappalli, Tamil Nadu. *J. Curr. Sci.,* 16: 207-210.

Sivakumar, B., Berndtsson, R., Olsson, J., Jinno, K. and Kawamura, A. (2000). Dynamics of monthly rainfall-runoff process at the Göta basin: a search for chaos. *Hydrol. Earth Syst. Sci.,* 4: 407-417.

Trivedy, R. K. and Goel, P. K. (1986). Chemical and biological methods for water pollution studies. *Environmental Publications*, Karad.

Wetzel, R. G. (1983). Limnology. 2nd ed. Saunders College Publishing, New York. p. 753.

Young, W. C., Hannan, H. H. and Tautum, J. W. (1972). The Physico-chemical limnology of a stretch on the Gaudalupe river, Texas with five main stream impoundments. *Hydrobiol.,* 40: 297-319.

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