RESEARCH ARTICLE

SEASONAL VARIATIONS OF NUTRIENTS IN PERUR CHETTIPALAYAM LAKE, COIMBATORE DISTRICT, TAMILNADU, INDIA

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ABSTRACT

The water quality was performed in Perur Chettipalayam Lake, Coimbatore District from July 2015 to June 2016, with specific regard to nutrient content. The nutrients investigated were phosphate, calcium, magnesium, chlorides, nitrates and sulphates. The obtained results showed marked seasonal changes in contamination of the sewage pond. The analyzed nutrient content shows that the lake is extremely contaminated with sewage

Keywords: Perur Chettipalayam Lake, nutrients and seasonal fluctuations.

1. INTRODUCTION

Water is a crucial component of the environment and it retains life on the earth. Due to over extending population increasing and industrial discharges, the demand for fresh water is increasing day by day. In today's situation, rapid industrialization, unplanned urbanization and unselective use of artificial chemicals cause heavy and mixed pollution in aquatic environments leading to degradation of water quality and consumption of aquatic fauna. Even the deterioration of water in ponds and tanks causes extreme problems in aquatic ecosystem and in spoiling the water quality. Physical and chemical parameters play an important role in determining the distribution pattern and quantitative abundance of organisms in a particular aquatic ecosystem (1).

A pond supports a man-made or natural water body with an area of between 2 and 1 m (20, 000 m^2 or ~5 acres) that can catch water for a few months of the year (mainly for four months or may be more) (2). Contamination of rivers and streams has become one of the most significant Environmental issues (3). Water quality usually means the water component that must be present in order for aquatic organisms to grow best (4).

Anthropogenic loads of nutrients may lead to extreme eutrophication, particularly where the circulation is restricted, such as in inlets and coastal lagoons (5). The nitrate ion (NO_3^-) is the general form of combined nitrogen found in natural water. It may be biochemically declined to nitrite (NO_2^-) by denitrification processes, generally under anaerobic conditions. The nitrite ion is promptly oxidized to nitrate. Nitrate is a vital nutrient for aquatic plants and seasonal variations can be caused by plant growth and decay (6).

2 MATERIALS AND METHODS

2.1. Study area and collection of water samples
2.1.1. Perur Chettipalayam Lake

The present attempt was made to analyze the water quality status of Perur Chettipalayam Lake. This study examines the seasonal variation in the different parameters of Perur Chettipalayam Lake between July 2015 and June 2016.

2.1.2. Sample collection

The samples were collected at the Perur Chettipalayam Lake water at the four stations listed below for the current research.

Fig. 1. Station I Before mixing point of sewage in Perur Chettipalayam Lake

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Fig. 2. Station II Mixing point of sewage in Perur Chettipalayam Lake

**Fig. 3. Station III After Mixing point of sewage in Perur Chettipalayam Lake**

Fig. 4. Station IV Raw sewage in Perur Chettipalayam Lake

Surface water samples were gathered from July 2015 to June 2016 between 11.30 am and 12.30 pm for a 12-months period. Samples in clean, white polythene containers have been collected. It must be able to be sealed tightly with a stopper or a cup. The bottle must be soaked with 10% hydrochloric acid for 24 hours and cleaned and rinsed thoroughly with distilled water. However, all containers should be rinsed with chromic acid solution (35 ml of saturated $Na_2Cr_2O_7$ in 1 liter of concentrated sulphuric acid), tap water and distilled water should be used. All procedures were according to Colorimetric/Titrimetric methods.
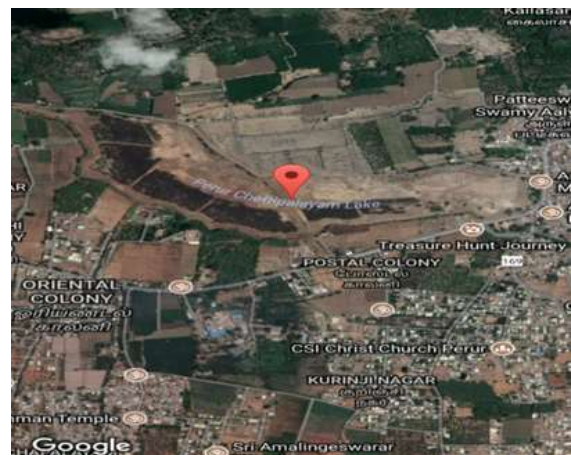
STUDY AREA
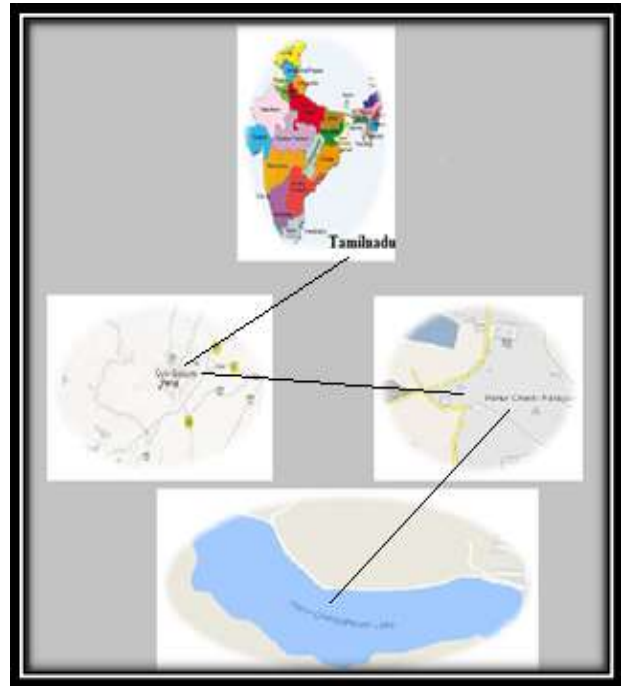
Fig. 5. Shows Map of Perur Chettipalayam Lake

Maps showing
1. Tamilnadu state
2. Coimbatore District and Perur city
3. Perur Chettipalayam (Study area)
4. Perur Chettipalayam Lake

Fig. 6. Google Satellite Map of the Perur Chettipalayam Lake

3. RESULTS AND DISCUSSION

The data for Station I, II and III seasonal variations in Perur Chettipalayam Lake nutrients are shown below (Tables 1 - 3).

3.1 NUTRIENTS
3.1.1 Phosphates

The values of phosphates were recorded as minimum and maximum (0.012 mg/l and 0.955 mg/l) during the month of February and March 2016 at stations I and II respectively. Mishra *et al.* (7) reported earlier high levels of phosphate during the monsoon season. Excessive nutrients in water can also cause contamination and eutrophication of groundwater (8,9).

3.1.2 Calcium

The calcium level was minimum (90.12 mg/l) during the month of March 2016 at station I and maximum (205.12 mg/l) during the month of December 2015 at station II. Hujare (10) has been reported that higher calcium concentrations are not desirable for washing and bathing due to the suppression of soap dither formation.

3.1.3 Magnesium

Minimum value of magnesium was recorded as 50.00 mg/l during the month of June 2016 at station I and maximum was recorded as 154.16 mg/l during the month of December 2015 at station II. Trivedi and Goel (11) and Singh and Mahajen (12) are of the view that the high hardness is suggestive of pollution due to domestic waste and industrial effluents.

3.1.4 Chlorides

The chlorides were minimum value at 40.00 mg/l during the month of September 2015 at station I and maximum as 260.00 mg/l during the month of March 2016 at station I. Prior to the development of bacteriological producers, chloride serves as a basis for detecting groundwater pollution from sewage (13).

3.1.5 Nitrates

The minimum value of nitrates was recorded as 0.22 mg/l during the month of January 2016 at station I and maximum value was recorded as 54.99 mg/l during the month of October 2015 at station II. Nitrates contribute to fresh water by discharging waste and industrial waste from agricultural fields (14).

3.1.6 Sulphates

The minimum value of sulphates was observed as 66.43 mg/l during the month of February 2016 at station I and maximum value was observed as 264.80 mg/l during the month of May 2016 at station II.

Higher concentrations of SO_4 can cause gastrointestinal irritation, especially in drinking water resources (15).

Data on seasonal variations in the different parameters of Perur Chettipalayam Lake for the Station IV (Raw sewage) are represented below (Table 3).

3.2 NUTRIENTS
3.2.1 Phosphates

The values of phosphates were recorded as minimum and maximum (0.4 mg/l and 0.9 mg/l) during summer season (March to June) and winter season (November to February) at station IV.

3.2.2 Calcium

The calcium level was minimum (76.50 mg/l) during rainy season (July to October) at station I and maximum (100.00 mg/l) during summer season (March to June) at station IV.

3.2.3 Magnesium

Minimum value of magnesium was recorded as 20.00 mg/l during rainy season (July to October) at station IV and maximum was recorded as 35.00 mg/l during summer season (March to June) at station IV.

3.2.4 Chlorides

The chlorides were minimum value at 110.00 mg/l during rainy season (July to October) at station IV and maximum as 250.00 mg/l during summer season (March to June) at station IV. 5.1.5

3.2. 5 Nitrates

The minimum value of nitrates was recorded as 40.00 mg/l during summer season (March to June) at station IV and maximum value was recorded as 50.00 mg/l during winter season (November to February) at station IV.

3.2.6 Sulphates

The minimum value of sulphates was observed as 120 mg/l during rainy season (July to October) at station IV and maximum value was observed as 260 mg/l during summer season (March to June) at station IV.

Table 1. Data on seasonal variations in Nutrients of Perur Chettipalayam Lake, Coimbatore for the year 2015 – 2016 at three stations (I, II and III)

Seasons	Parameters	Phosphates (mg/l)			Calcium (mg/l)			Magnesium (mg/l)		
	Months	SI	SII	SII	SI	SII	SIII	SI	SII	SIII
Rainy	Jul - 2015	0.029±0.011	0.708±0.011	0.560±0.061	124.08±1.00	152.00±0.76	145.02±0.11	64.71±0.15	144.45±0.27	140.25±0.20
	Aug	0.028±0.001	0.700±0.011	0.340±0.030	114.06±0.44	159.01±0.28	151.07±0.27	60.05±0.05	148.02±0.05	140.05±0.05
	Sep	0.016±0.005	0.718±0.011	0.700±0.036	117.08±0.21	159.06±0.44	154.04±0.76	60.15±0.12	147.02±0.22	145.02±0.05
	Oct	0.050±0.011	0.712±0.010	0.650±0.050	112.02±0.51	154.08±0.32	150.02±0.22	61.24±0.25	141.04±0.10	130.06±0.21
Winter	Nov	0.016±0.005	0.668±0.002	0.154±0.005	138.54±0.40	192.34±0.82	**190.01±0.22**	76.80±0.15	152.25±0.25	145.07±0.09
	Dec	0.018±0.002	0.672±0.004	**0.151±0.007**	139.67±0.84	**205.12±0.26**	182.04±0.05	78.10±0.10	**154.16±0.10**	144.08±0.10
	Jan - 2016	0.014±0.004	0.614±0.005	0.180±0.010	134.00±1.04	190.78±5.56	170.12±0.26	75.14±0.10	150.00±0.64	**148.06±0.38**
	Feb	**0.012±0.002**	**0.610±0.005**	0.145±0.005	**130.00±2.75**	184.16±0.25	170.00±1.32	**79.10±0.55**	156.14±0.10	144.16±0.20
Summer	Mar	0.017±0.005	**0.955±0.012**	0.774±0.051	**90.12±0.26**	122.24±0.15	100.14±0.25	54.04±0.05	**134.11±0.07**	130.42±0.30
	Apr	0.014±0.004	0.823±0.013	0.800±0.045	92.00±0.50	**120.15±0.21**	110.06±0.10	52.08±0.05	130.50±0.17	**130.00±0.87**
	May	**0.032±0.002**	0.864±0.010	0.820±0.025	98.00±0.76	122.10±0.26	120.00±0.65	50.08±0.06	130.64±2.54	130.30±0.25
	Jun	0.015±0.005	0.943±0.010	**0.834±0.030**	95.00±0.50	121.00±0.76	**100.00±1.32**	**50.00±0.76**	132.86±0.21	131.00±0.41
Standards	WHO	0.5			200			50		
	ICMR	No limit stated			75			30		
	BIS	0.2			200			30 - 70		

Values were expressed as mean ± S. D of three replicates using SPSS statistical package.
Standards: World Health Organization (1963), Indian Council of Medical Research (1975) and Bureau of Indian Standards: IS 10500 (2012).

Table 2. Data on seasonal variations in Nutrients of Perur Chettipalayam Lake, Coimbatore for the year 2015 – 2016 at three stations (I, II and III)

Seasons	Parameters	Chlorides (mg/l)			Nitrates (mg/l)			Sulphates (mg/l)		
	Months	SI	SII	SIII	SI	SII	SIII	SI	SII	SIII
Rainy	Jul - 2015	65±0.30	172±0.26	71±0.65	0.30±0.18	54.40±0.20	21.20±0.05	70.88±0.01	179.56±0.03	175.74±0.05
	Aug	60±0.70	**170±0.40**	65±0.49	0.62±0.03	54.90±0.10	21.15±0.04	74.00±0.43	189.34±0.10	175.45±0.10
	Sep	**40±0.55**	174±0.52	72±0.43	0.42±0.04	54.86±0.03	21.40±0.03	76.18±0.02	179.78±0.02	170.78±0.04
	Oct	48±0.56	174±0.52	**70±2.61**	**0.86±0.02**	**54.99±0.01**	21.25±0.02	78.12±0.02	180.65±0.04	175.60±0.15
Winter	Nov	75±3.27	188±0.65	80±0.47	0.50±0.01	36.30±0.15	**22.20±0.07**	69.55±0.01	**173.74±0.05**	160.60±0.15
	Dec	70±0.65	189±1.00	85±0.62	0.87±0.02	**29.24±0.05**	27.00 ±0.49	84.00±0.41	175.40±0.30	164.72±0.05
	Jan - 2016	78±0.36	186±2.51	75±0.61	**0.22±0.01**	35.25±0.02	25.26±0.02	86.00±0.43	177.89±0.01	166.25±0.16
	Feb	75±3.27	185±1.00	82±0.47	0.40±0.01	32.56±0.03	28.10±0.04	**66.43±0.01**	178.34±0.05	**160.00±0.15**
Summer	Mar	75±3.27	**260±1.52**	110±0.66	0.35±0.02	34.40±0.20	30.18±0.01	**90.68±0.01**	226.54±0.03	215.50±0.05
	Apr	76±0.41	220±2.00	100±0.56	0.50±0.17	36.65±0.05	32.05±0.04	92.72±0.04	228.15±0.05	**225.48±0.02**
	May	75±3.27	218±2.08	120±0.43	0.98±0.01	38.55±0.01	**35.08±0.03**	94.14±0.05	**264.80±0.10**	215.94±0.05
	Jun	**79±0.50**	204±3.05	**130±0.47**	0.65±0.01	36.85±0.04	34.10±0.62	92.10±0.04	221.45±0.15	215.86±0.07
Standards	WHO	250			50			200		
	ICMR	200			45			200		
	BIS	250			45			200		

Values were expressed as mean ± S. D of three replicates using SPSS statistical package.
Standards: World Health Organization (1963), Indian Council of Medical Research (1975) and Bureau of Indian Standards: IS 10500 (2012).

Table 3. Data on seasonal variations in Physico–chemical parameters and Nutrients of Perur Chettipalayam Lake at Station IV (Raw sewage) for the year 2016

| Parameters Physico-chemical Parameters and Nutrients | Units | Station IV (Raw sewage) | | | | | |
| | | Seasons | | | Standards | | |
		Rainy	Winter	Summer	WHO	ICMR	BIS
Water temperature	^{O}C	**25±0.32**	26±1.00	**29±2.64**	35	No Limit stated	No Limit stated
Colour	-	Brownish	**Black**	**Greenish**	No Limit stated	No Limit stated	No Limit stated
Electrical conductivity	μmhos	**280±7.6**	360±0.90	**382±0.38**	300	300	300
Suspended solids	mg/l	**200±5.0**	240±0.45	**390±0.76**	500	No Limit stated	No Limit stated
Dissolved solids	mg/l	**300±10.0**	460±0.87	**540±0.49**	500	500	500-1000
Total solids	mg/l	**500±3.21**	700±0.66	**930±0.42**	30	No Limit stated	No Limit stated
Light penetration	cms	**200±5.0**	245±0.36	**280±0.60**	No Limit stated	No Limit stated	No Limit stated
Phosphates	mg/l	**0.9±0.43**	0.6±0.20	**0.4±0.20**	0.5	No Limit stated	0.2
Calcium	mg/l	**76.5±1.04**	87.0±0.55	**100.0±0.36**	200	75	200
Magnesium	mg/l	**20±0.53**	25±0.49	**35±0.47**	50	30	30-70
Chlorides	mg/l	**110±0.76**	220±0.60	**250±0.80**	250	200	250
Nitrates	mg/l	46±0.80	**50±0.59**	**40±0.61**	50	45	45
Sulphates	mg/l	**120±1.32**	240±0.71	**260±0.36**	200	200	200

Values were expressed as mean ± S. D of three replicates using SPSS statistical package.
Standards: World Health Organization (1963), Indian Council of Medical Research (1975) and Bureau of Indian Standards: IS 10500 (2012).
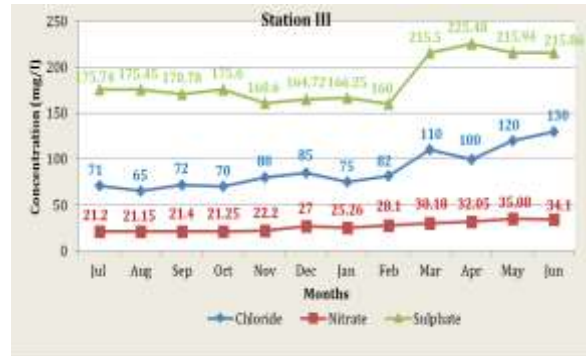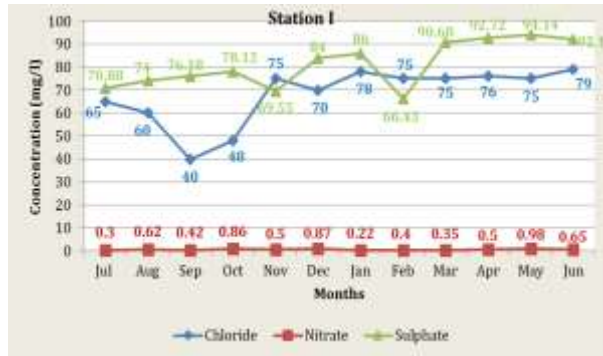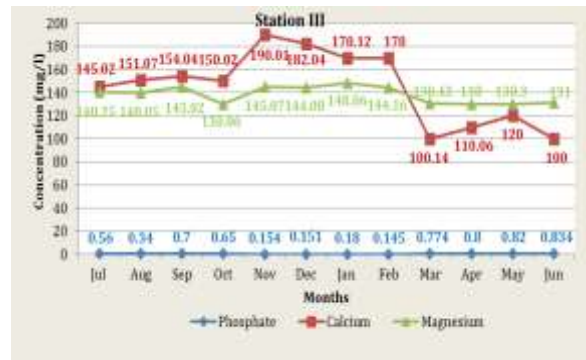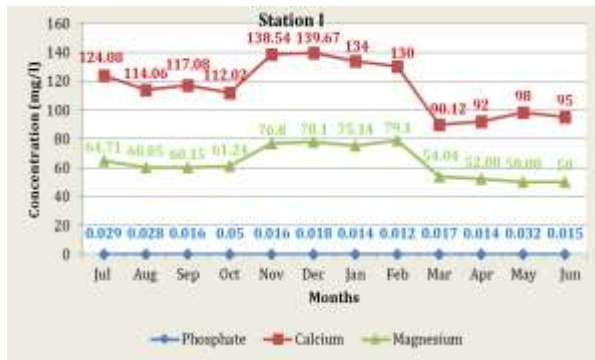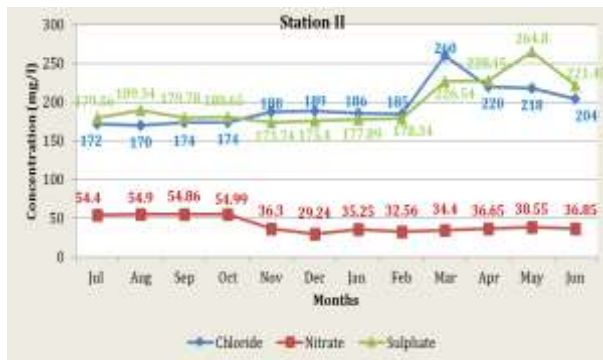
Fig. 7. Data on seasonal variations on nutrients of Perur Chettipalayam Lake, Coimbatore at Station I for the year 2015-2016

Fig. 9. Data on seasonal variations on nutrients of Perur Chettipalayam Lake, Coimbatore at Station III for the year 2015 – 2016

4. CONCLUSION

The results of the above parameters have shown that the present study clearly shows that the quality of the water depends on the type of pollutant added. Due to the mixture of agricultural pollutants with fertilizers and domestic sewage, the amount of phosphates, calcium, magnesium, chlorides, nitrates and sulphates was found to be high. Therefore, periodic monitoring can help to prevent contamination of the lake water of the region.

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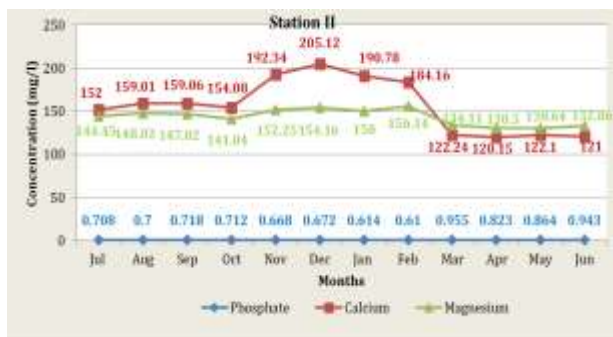
Fig. 8. Data on seasonal variations on nutrients of Perur Chettipalayam Lake, Coimbatore at Station II for the year 2015 – 2016

43

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