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Research Article

PHYSICO-CHEMICAL FEATURES OF A MIGRATORY VISITED POND IN THE FRESHWATER ENVIRONMENT OF KANYAKUMARI DISTRICT

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ABSTRACT
Freshwater habitats such as ponds, lakes tanks and reservoirs hold great promise primarily as source of drinking water and irrigation. However the healthy ecological conditions of freshwater bodies have been spoiled by several anthropogenic activities, landing of migratory birds, and by natural calamities. Factories like BOD, Po_4, No_3….were analyzed to find out the eutrophicated nature of the pond. Po_4 and No_3 level of the pond, water enriches the growth of aquatic weeds and phytoplankton which safeguard the pond from pollution.

Keywords: *Eutrophication, Pond, Productivity and Anthropogenic Activity*

INTRODUCTION
Water of good quality is required for all living organisms and most water bodies become contaminated by the incorporation of anthropogenic society. The increased demand for water as a consequence of population growth, agriculture and industrial development has made the environmentalist to determine the physical, chemical and biological features of all water resources (Jeyabhaye *et al.*, 2008). Water quality parameters furnish the basis for judging the suitability of water for its designated uses and for improving the existing conditions (Shinde *et al.*, 2010).
For the beneficial uses current information is needed on water quality programes and it was analysed by several researchers (Kulkarni 2002, Ravindra 2003, Sadhuram 2005, Jadhav *et al.*, 2006), since ponds are favorable habitats for a variety of flora and fauna and also used by the migratory birds, hence regular monitoring of water quality is necessary. The ecological behavior of ponds changed by a number of physical, chemical, factors, such as climate, geological differences etc (Solanki *et al.*, 2007).
In the present study a migratory visited pond (Suchendrum pond, located in kariamanikapuram village, on the way to Kanyakumari, Agastheeswaram taluk) of kanyakumari district was chosen to study the impact of biotic activities on physico-chemical characteristics of pond water. The study was performed during January 2010 to December 2011. The pond water is not used for domestic purposes and the middle portion of the pond looks like an island with trees and surround by grasses. *Eichornia* species spread along the margin of the pond. Migratory birds frequently visited this pond, as the pond is enriched by a variety of fish population, protected shelter of the trees and undisturbed environmental situations of the village.

MATERIALS AND METHODS
Water samples were collected monthly at 9 am from the experimental pond for the analysis of various physico-chemical parameters following the standard methods of APHA (1985).

RESULTS AND DISCUSSION
Water temperature is considered as an important physical factor which influences the chemical changes of water and its quality (Kumar and Cini 2009). The temperature ranges from 25.40^0C to 27^oC, the highest temperature was noted during non-monsoon season and the lowest was recorded during northeast monsoon season (Table.1). Generally increased temperature corresponds to the reduced level of water in the pond, higher solar radiation and depth of water bodies. Similar results have been made from the

studies of Subashini and Saradhamani (2005a), Santhosh *et al.,* (2006), and Soyeswara *et al.,* (2010) from varies fresh water ponds.

P^H of the water is an essential factor that gives a precious indication of its quality and an index of pollution (Wang *et al.,* 2002, Rajkumar *et al.,* 2006). Present observation indicated lower p^H value was (6.9 to 7.5) during monsoon and higher p^H in the non-monsoon season (Table 1) which could be attributed to the increased photosynthetic assimilation of dissolved organic carbon by planktons (Heejare, 2008a; Ganai *et al.,* 2010 and Patra *et al.,* 2010). A sharp declere of p^H in the studied pond was by the mixing of freshwater influx, low temperature, decomposition of organic matter and by the reduced algal population (Sharma and Sarang, 2009 and Misra *et al.,* 2005).

Dissloved oxygen finds a place of important in the aquatic environment and its concentration depends on factors such as temperature, decomposition processes, photosynthesis and the level of aeration (Manonmani, 2010). In the present study, the DO concentration decreased during non-monsoon (6 mg/L and 5.54 mg/L) which was mainly by the moderate temperature (Harsha and Mallammanavar, 2004) low solubility (Verma *et al.,* 2011) and enhanced microbial activity (Manonmani 2010). During monsoon increased amount of oxygen was produced by the circulation and mixing of surrounding rain water into the study pond (Koshy and Vasudevan, 1999) and it was associated with higher plantonic biomass (Varughese *et al.,* 2009). Moreover decreased amount of dissolved oxygen was an indication of organic pollution (Pawar, 2010).

Biological oxygen demand is a measure of degradable organic matter in the water (Karne and Prabbakar, 2009) and it provide valuable information of pollution status (Hosetti *et al.,* 1994). In the two years of observation reduced level (1.30 mg/l to 1.52mg/l) of BOD during monsoon and increased level during non-monsoon season (1.98mg/l) in the study pond was observed. The excreta and number of birds visited during December to February was more and the eutrophication process becomes excessive and causes rich growth of aquatic weeds. The water level also reduced which causes an increase of BOD levels during non-monsoon season. Similar observations were made from the studies of Kumar and Sharma (2005) and Khare *et al.,* (2007). According to standards the values of BOD should not be more than 6mg/l (Mahadev *et al.,* 2010). In the present observation the BOD levels remain below the standard which indicated low level of organic pollution. The level of BOD depends on temperature, density of plankton, concentrations of organic matter and other related factors (Parvatesam *et al.,* 1993).

Phosphate exists in dissolved and particulate form in the aquatic environment which limits the nutrient load for phytoplankton growth and controls primary productivity (Shinde *et al.,* 2011). Excess amount of phosphorus can cause eutrophication leading to algal blooms (Munawar, 1970). The amount of phosphate content showed higher concentration (0.98mg/l and 0.49mg/l) during southwest monsoon. According to Karne and Prabhakar (2009) the increase in phosphate values in monsoon was due to the surface run off, from the agricultural fields, rain fall and by the rich deposition of soil from the surrounding area. Moreover the waste material from the excreta of the birds also enriches the aquatic environment.

Nitrite is formed as an intermediate compounded resulted during the inter conversion process of nitrate and ammonia. Under aerobic condition nitrate is reduced to nitrite by de nitrification process (Harsha *et al.,* 2006). In the present observation the values on nitrite and nitrate levels were higher during monsoon season. Similar observation were made by Das (2000) and Segal (2003). Moreover the pond receives water from the nearby paddy fields, decayed macrophytes, and decomposed nitrogenous materials which increases the nitrate levels as reported by Vimala *et al.,* (2006). The minimum level obtained during non-monsoon season was due to the utilization of phytoplankton nitrogenous substances by the in biological destruction and self purification properties of water bodies (Karne and Prabhar, 2009). **A**ccording to Kumar and Ravindranath (1998) the nitrate concentration of more than 5mg/l in water usually indicate pollution made by human and animal wastes or fertilizer run of.

Potassium is a main cation in the aquatic ecosystem and its occurrence is mainly by meterological and agriculture factors (Mohandas and Reddy, 1987). Present observation reported higher concentrations during southwest monsoon season in both the years of observation. The higher levels may be due to the birds waste, that dissolves in water as evidenced by Esakki (2006) in koonthankulam bird sanctuary pond.

According to Kaushik *et al.,* (1991) sedimentation and utilization of potassium by biota caused a decrease in its content during northeast monsoon season.

Calcium forms the most abundant element in freshwater imparting hardness and serves as one of the micronutrient that influences the flora of ecosystem in metabolism and growth (Rajakumar *et al.,* 2006; Garg *et al.,* 2006).

It is an important constituent of the skeletal structure of organisms (Thilaga, 2004). Present observation should higher values during non-monsoon and minimum during monsoon. The higher values were mainly due to the rapid decomposition of organic matter as evidenced from the studies of Billore (1981) and dissolution of sedimentary rocks (Das *et al.,* 2001).

The lower values may be due to the increase in biomass especially gastropod which consume available calcium (Singh and Jha, 2000). Calcium functions as an indication of pollution and eutrophication (Khabrade and Mule, 2005).

Rain water brings maximum concentrations of magnesium, which causes hardness and produce unplacent taste to water (Narayan *et al.,* 2005). Maximum concentration was reported during non-monsoon and minimum amount during monsoon season.

Venkatasubramani and Meenambal (2009) reported their magnesium is often associated with calcium in all kinds of water but the concentration often remains lower than calcium. Megnesium is an essential element for chlorophyll growth and also it serves as a limiting factor for the growth of phytoplankton.

Sodium play an important role in buffering the p^H changes in aquatic environment (Hsue and Chen, 2000). Concentrations remains low during monsoon and high during non monsoon season of the study and the levels were increased because of the addition of fertilizers in the surrounding area of the pond and according to Solanki (2001) shrinkage of water volume increased the concentrations during summer. The concentrations was also lowered by rainfall during monsoon season (Gadhiri *et al.,* 2004).

Chloride concentration is used as an important parameter for the detection of contamination by sea wage. It occur as NaCl, $MgCl_2$ and $CaCl_2$ in natural water (Freeda *et al.,* 2006). The high amount of chloride was recorded during summer and low values were observed during monsoon season. The increase in chloride content may be due to the increased temperature and evaporation of water body as reported by Khabrade and Mule (2005).

Rajkumar *et al.,* (2006) has suggested that higher concentrations of chloride were an index of pollution of animal origin and it is supported by Cole (1979).

Alkalinity value provides an idea of natural salts present in water and it is a measure of buffering capacity (Gawas *et al.,* 2006). It may be caused due to evolution of Co_2 during decomposition of organic matter (Venkadesh *et al.,* 2009). In the present study higher values during non monsoon and lower values during monsoon season was reported.

Similar finding were noticed earlier by Chaterjee and Mohanty (1990) and Rathore *et al.,*(2006). Decomposition of organic waste in the pond may increases the level of alkalinity as evidenced from the studies of Rao *et al.,* (1993).

Total dissolved solids are the solids of water in the dissolved state which contains carbonates, bicarbonates, chloride, calcium, phosphate etc (Esmaeili and Johal, 2005). Excess amount of TDS in waters disturbed the ecological balance and cause suffocation to the aquatic flora (Klein, 1972). Present observation reported higher concentration during non-monsoon and lower concentrations during monsoon seasons. which is similar to the findings of Nagaraja *et al.,* (2011) and Shamal (2011). Excess amount of TDS may be due to the presence of higher rate of evaporation during summer (Hutchinson 1957) and also by the increased amount of surface runoff (Pawar 2010).

From the results obtained it can be concluded that the pond is with higher amount of nutrients which leads to eutrophication. By the excreation and dead remanents of young ones, and dead fishes etc causes the pond to become more rich in nutrient level.

Seasonal observation of physico-chemical parameter during the year 2010 January to 2011 December

parameters	Season	2010 January to December	2011 January to December
	NMS	27.50 ± 0.10	27.20 ± 0.25
Temperature (^oC)	SWM	25.10 ± 0.10	26.00 ± 0.10
	NEM	25.16 ± 0.05	25.40 ± 0.49
	NMS	7.07 ± 0.68	7.9 ± 0.52
P^H	SWM	7.18 ± 0.30	7.5 ± 0.24
	NEM	6.9 ± 0.34	7.3 ± 0.24
	NMS	6.00 ± 0.05	5.54 ± 0.81
D.O(mg/L)	SWM	6.42 ± 0.49	7.61 ± 0.22
	NEM	6.60 ± 0.80	6.44 ± 0.94
	NMS	1.87 ± 0.09	1.98 ± 0.08
B.OD(mg/L)	SWM	1.62 ± 0.20	1.66 ± 0.61
	NEM	1.52 ± 0.22	1.30 ± 0.44
	NMS	0.89 ± 0.02	0.28 ± 0.07
Phosphate (mg/L)	SWM	0.98 ±0.08	0.49 ± 0.02
	NEM	0.81 ± 0.04	0.32 ± 0.2
	NMS	0.28 ± 0.11	0.88 ± 0.05
Nitrate (mg/L)	SWM	1.34 ± 0.21	1.64 ± 0.38
	NEM	0.91 ± 0.34	1.27 ± 0.18
	NMS	0.08 ± 0.01	0.31 ± 0.09
Nitrite (mg/L)	SWM	0.49 ± 0.2	0.85 ± 0.35
	NEM	1.11 ± 0.81	0.87 ± 0.41
	NMS	8.5 ± 2.18	9.65 ± 5.16
Potassium (mg/L)	SWM	9.4 ± 0.94	12.4 ± 7.3
	NEM	4.27 ± 1.61	11.5 ± 0.57
	NMS	35.6 ± 6.67	26.42 ± 4.38
Calcium (mg/L)	SWM	20.2 ± 4.40	21.7 ± 6.73
	NEM	14.48 ± 2.90	20 ± 5.17
	NMS	15.8 ± 3.01	16.60 ± 7.81
Magnesium (mg/L)	SWM	9.82 ± 2.6	14.62 ± 6.18
	NEM	8.47 ± 2.20	9.5 ± 6.0
	NMS	68.18 ± 12.5	29.42 ± 12.30
Sodium (mg/L)	SWM	34.81 ± 9.6	48.5 ± 12.01
	NEM	28.6 ± 7.61	43.75 ± 3.90
	NMS	85.12 ± 18.90	55.18 ± 18.6
Chloride (mg/L)	SWM	62.74 ± 14.94	33.42 ± 21.5
	NEM	5.4 ± 16.21	31.5 ± 20.4
	NMS	169.78 ± 19.6	103.5 ± 15.11
Total Alkalinity (mg/L)	SWM	96.64 ± 14.9	74.8 ± 18.5
	NEM	80.04 ± 11.2	60.6 ± 11.2
	NMS	465 ± 54.73	310 ± 40.6
TDS (mg/L)	SWM	316 ± 27.90	218 ± 20.72
	NEM	294 ± 38.5	243 ± 31.43

NMS- Non monsoon or summer; SWM- Southwest monsoon;
NEM- Northeast monsoon

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