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PHYSICO-CHEMICAL CHARACTERISTICS OF THE PONDS CHERUKULANGARA AND ARYANAMBI IN KERALA

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ABSTRACTS

The quality of water is identified in terms of its physical, chemical and biological parameters. Limnological features of two such temple ponds, the Cherukulangara temple pond and Aryanambi temple pond were undertaken in the present study. The biological parameters of the ponds were also made during the study. In the present investigation all the parameters showed higher values in Pond B compared to Pond A. All values are found to be within or less than the permissible limit. Both ponds showed an oligotrophic nature with the presence of poor nutrients and low vegetation. Both ponds are unpolluted fresh water bodies which have no chemical or sewage pollution. It is suggested that the higher authorities should take steps to maintain the quality of fresh water bodies including ponds from all kinds of pollution and balance the fresh water ecosystem.

Keywords: Pollution,Cherukulangara temple pond,Aryanambi temple pond,Water quality and Air.

1. INTRODUCTION

Water also performs unique and indispensible activities in earth ecosystem, biosphere and biogeochemical cycles.Approximately 70% of the water in India has become polluted due to the discharge of domestic sewage and industrial effluents into natural water source, such as rivers, streams as well as lakes (Sangu and Sharma,1987).

The quality of water is described by its physical, chemical and biological characteristics. But if, some correlations were possible among these parameters, then significant ones would be fairly useful to indicate the quality of water (Dhembare *et al*., 1997). The deterioration of quality, loss of biodiversity and fast depletion of water resources are the main challenges, which need urgent attention.A pond is an earthern container for storing water. A pond os a dynamic and ever-changing community of plants and animals.

2. MATERIALS AND METHODS

The study of Cherukulangara temple was in the Palakkad district in Kerala. is situated near rice field and agricultural land, Thrichur in Kerala. The pond is used for bathing and it is a main source for the irrigation purposes during summer season. The Aryanambi temple pond is situated in Palakkad., Kerala. There are four bathing ghats in the pond.The study was conducted during the period from November to February (2012-2013) by which temperature range was in between 25^{o}C and 19^{oC}and the rainfall is about 3.5 to 2111.4mm. The analysis of all parameters like "total solids, dissolved oxygen, free carbon dioxide, carbonate, bicarbonate, calcium, magnesium, chloride, sulphate, phosphate, nitrate, iron, silicate and biological oxygen demand were estimated in the laboratory following the standard methods of APHA (2005).Qualitative analysis of plankton and fishes were also made in both the ponds A and B. Plankton were studied under compound microscope and identified with the help of standard references (Adoni *et al*., 1985; Agarker *et al*., 1994).

3. RESULTS AND DISCUSSION

During experimental period (November 2012 to February 2013), the environmental temperature ranged between 25°C and 32°C in pond A and in pond B, it was between 26°C and 33°C in pond B.The highest air and water temperature value (33°C and 25°C) was recorded in February in pond B and the lowest air and water temperature value (25°C and 19°C) was recorded in pond A in December. The water temperature was consistently lower than the atmospheric temperature. Similarly the bottom water temperature was consistently lower than the surface water.

pH values varied between 6.33 to8.0 in both A and B ponds. The maximum pH value was recorded 8.0 ± 0 in Pond B during December and minimum value was recorded 6.33 ± 0.29 in Pond A during November.In the present investigation the pH values were maximum during December and minimum during November. Besides the Pond B showing high pH value by comparing with Pond A, while both ponds keeping same variation of pH from slightly acidic to slightly alkali during November to February.

Maximum value of total solids was observed in Pond B(2333.33±288.67mg/L) and minimum value was observed in Pond A(833.33±288.67mg/L). Based on the seasonal variation it was observed that the maximum value was found during November and ranged from 1833.33mg/L to 2333.33mg/L and minimum value was observed during January and ranged from 833.33 to 1500mg/L.From these two Ponds Pond A showed high TS content than Pond B.In both the ponds,bottom water showed high TS content than surface water.

Dissolved oxygen (DO) values ranged from 3.66 mg/L to 6.34 mg/L of which maximum value (6.34± 0.28 mg/L) was noted in Pond A during December and minimum value (3.66 ± 0.05 mg/L) in Pond B during February. Seasonally it is observed that DO values was more in December followed by January, November and less value was found in February in both the ponds. From these two ponds Pond A showed high oxygen level than Pond B.In both the ponds,surface water showed high oxygen level than bottom water.

Free Carbon dioxide is also one of the most important factors in aquatic habitat. It is highly soluble in water and is the main source of carbon path way in the nature. Plant absorbs the free carbon dioxide present in both atmosphere and water. Carbon dioxide in water bodies is contributed by the respiratory activity of the animals (Vasumathy *et al*.,2009). Free carbon dioxide in the present study varied from an average of 2.75 mg/L to 14.41mg/L. The lowest value (2.75 ± 0.421 mg/L) of free carbon dioxide was recorded in the surface water of Pond A in December month (winter season) where as the highest value (14.41 ± 0.751 mg/L) was observed in the bottom water of Pond B during the period of January (pre summer season). Pond B showed consistently higher carbon dioxide than that of Pond A. Similarly the bottom water showed higher carbon dioxide than surface water. Seasonally carbon dioxide was more in January followed by November,January and less value was found in December in both ponds.

Carbonate is an important parameter which contributes to alkalinity. But in the present study, the bicarbonate was found to be absent. Bicarbonate is an important parameter which contributes to alkalinity.Value was varied from an average of 0 to 23.33mg/L 0f which maximum value(23.33± 2.886mg/L)was observed in bottom water of Pond B during February,2013(pre summer season).During December,2012 (winter season)the bicarbonate was totally absent in Pond A.

Calcium was found higher (28.33 ± 2.886 mg/L) in the bottom water of Pond B in January and lower (8.33 ± 2.886 mg/L) in the surface water of Pond A in November. The calcium value was fluctuated from an average of 11.66 to 28.33 mg/L in Pond B and is higher when it is compared with Pond A. Seasonally calcium was more in January followed by October, December and less value was found in November in both ponds. The presence of calcium in the bottom water was consistently higher than the surface water in both ponds.

Salts of magnesium are found dissolved in all water. Rocks are the main source of magnesium. It is needed by all animals for phosphate transfer involving ATP and ADP. Magnesium was found maximum (23.33 ± 2.886 mg/L) in the deeper part of Pond B in November and minimum (3.33 ± 2.886) in the surface water of Pond A in January. The magnesium value was fluctuated from an average of 8.33 ± 2.886 mg/L to 21.66 ± 5.773mg/L in Pond B is higher when it is compared with Pond A. The magnesium level in the deeper water was consistently higher than that of surface water.

The ecological significance of chloride lies in its potential to regulate salinity of water and exert consequent osmotic stress on biotic communities (Shinde *et al*., 2001). Chloride showed high significant positive relationship with water temperature, bicarbonate and calcium. The chloride content in studied ponds varied from an average of 28.4 to 68.63 mg/L in Pond A, while in the Pond B its contents ranged from 35.5 to 85.2 mg/L respectively. The chloride content was lower than the maximum permissible limit prescribed by WHO standards (1993). It was observed that Pond B having more chloride content than Pond A, where as the bottom water having high chloride content than the surface water in both ponds during the study period. Seasonally, chloride was more in February followed by November, January and less value was found in December in both ponds.

Sulphate level was maximum (98.16 ± 1.44 mg/L) in November at the bottom water of Pond B, while the minimum value (60.72 ± 1.639 mg/L) was observed in surface water of Pond A during pre summer season (February).Seasonally it can be said that sulphate was more in November followed by December, January and less value was found in February in both ponds. Pond B was leading in the amount of sulphate than Pond A in all seasons. Bottom water was observed consistently higher sulphate than surface water. The overall value was less than maximum permissible limits (500 mg/L) according to WHO standards (1993), indicating that

the pond was free from sulphate pollution during the study periods.

Phosphate level was maximum (0.84±0.15mg/L)was observed in the surface water of Pond A during February month(pre summer season). Seasonally it can be say that phosphate was more in November followed by December,January and less value was found during February in both ponds.Pond B recorded high amount of phosphate than Pond A in all seasons.Bottom water consistently higher phosphate than surface water.

Nitrate level was maximum (37.54±0.88mg/L)in February at the bottom water of Pond B, while the minimum value (18.80±1.20mg/L) in February at the surface water of Pond A.Nitrate values were more in November followed by December, January and less value was found in February in both ponds.From these two ponds Pond B showed high nitrogen level than Pond A in all seasons. Similarly bottom water showed high nitrate level than surface water.

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Table.1. Temperature of Cherukulangara temple pond during the study period Nov. 2012 – Feb. 2013.

Parameters	Nov.2012			Dec.2012			Jan.2013			Feb.2013		
	Cherukulangara Temple pond			Cherukulangara Temple pond			Cherukulangara temple pond			Cherukulangara temple pond		
	Air	Surface Water	Bottom water	Air	Surface water	Bottom water	Air	Surface water	Bottom water	Air	Surface water	Bottom water
Temperature (^oc)	28	21	19	25	19	17	26	20	18	32	24	22

Table.2. Temperature of aryanambi temple pond during the study period Nov.2012-Feb.2013

Parameters	Nov.2012 aryanambi temple pond			Dec.2012 Aryanambi temple pond			Jan.2013 Aryanambi temple pond			Feb.2013 Aryanambi temple pond		
	Air	Surface Water	Bottom water	Air	Surface water	Bottom water	Air	Surface water	Bottom water	Air	Surface water	Bottom water
Temperature (^oc)	29	22	20	26	20	18	27	21	19	33	25	23

Table.3. Chemical parameters of Aryanambi temple pond during the study period Nov.2012-Feb.2013

Parameters	Nov.2012		Dec.2012		Jan.2013		Feb.2013	
	Cherukulangara Temple pond		Cherukulangara Temple pond		Cherukulangara temple pond		Cherukulangara temple pond	
	Surface Water	Bottom water	Surface water	Bottom water	Surface water	Bottom water	Surface water	Bottom water
Total solids	1833.33±288.67	2000±500	833.33±288.67	1000±0	833.33±288.67	1000±0	1333.33±288.67	1500±0
Ph	6.33±0.29	6.5±0	7.5±0.5	7.66±0.29	6.83±0.29	7±0.5	6.5±0	6.5±0.5
DO_2	4.79±0.28	4.51±0.28	6.34±0.36	5.92±0.28	5.35±0.28	5.07±0.28	4.51±0.56	4.47±0.36
DCo_2	6.16±0.35	4.84±0.35	3.81±0.25	2.75±0.41	3.96±0.44	3.55±0.56	7.92±0.35	7.48±0
Carbonate	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Bicarbonate	6.66±2.88	13.33±2.88	Nil	Nil	5±0	6.66±2.88	15±5	18.33±2.88
Calcium	18.33±2.88	20±0	8.33±2.88	10±0	13.33±2.88	15±0	21.66±2.88	21.66±5.77
Magnesium	16.66±2.88	16.66±5.773	6.66±2.88	8.33±2.88	3.33±2.88	5±0	13.33±2.88	15±0
Chloride	49.7±7.1	54.43±4.91	28.4±7.1	33.13±4.09	47.33±4.099	49.7±7.1	63.9±7.1	68.63±4.099
Sulphate	79.68±0.783	81.6±1.357	72.96±0.783	76.8±0.96	67.2±1.752	69.84±0.919	60.72±1.639	63.36±1.357
Phosphate	0.61±0.11	0.66±0.12	0.52±0.18	0.56±0.13	0.38±0.11	0.42±0.05	0.30±0.05	0.36±0.20
Nitrate	35.5±0.55	36.22±0.60	30.25±1.25	31.04±1.22	22.20±1.50	23.44±0.22	18.80±1.20	19.80±1.25

Table.4. Chemical parameters of Aryanambi temple pond during the study period Nov.2012-Feb.2013

Parameters	Nov.2012		Dec.2012		Jan.2013		Feb.2013	
	Aryanambi temple pond		Aryanambi temple pond		Aryanambi temple pond		Aryanambi temple pond	
	Surface Water	Bottom water	Surface water	Bottom water	Surface water	Bottom water	Surface water	Bottom water
Total solids	2166.66±288.67	2333.33±288.67	1666.66±288.67	2000±0	1333.33±288.67	1500±0	1833.33±288.67	2166.66±288.67
Ph	6.6±0.29	6.83±0.29	7.83±0.29	8.0±0	7.33±0.29	7.5±0.5	6.83±0.29	7.0±0.5
Do_2	4.08±0.36	3.94±0.28	5.49±0.36	5.07±0.28	4.93±0.36	4.79±0.28	3.80±0.36	3.66±0.28
Dco_2	12.43±0.22	10.78±0.56	6.60±0.44	6.45±0.25	8.80±0.44	7.33±0.25	14.41±0.75	13.64±0.44
Carbonate	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Bicarbonate	13.33±2.88	20±0	5±5	6.66±2.88	10±0	11.66±2.88	21.66±2.88	23.33±2.88
Calcium	20±5	23.33±2.88	11.66±2.88	13.33±2.88	15±0	16.66±2.88	25±0	28.33±2.88
Magnesium	20±0	23.33±2.88	10±0	11.66±2.88	8.33±2.88	10±0	16.66±2.88	21.66±5.773
Chloride	56.80±7.1	59.16±8.198	35.5±7.1	40.23±4.099	35.5±7.1	42.6±7.1	73.36±4.099	85.2±7.1
Sulphate	95.76±0.919	98.16±1.44	90.0±0.919	93.36±0.919	85.44±0.783	87.36±0.96	74.4±0.554	78.08±0.554
Phosphate	0.80±0.08	0.84±0.15	0.77±0.08	0.79±0.13	0.62±0.11	0.65±0.12	0.54±0.12	0.58±0.16
Nitrate	36.12±1.02	37.54±0.88	34.0±0.50	34.92±0.18	25.55±0.15	28.22±0.80	20.40±0	22.10±0.22

Fig.1.Showing Temperature variation in Pond A

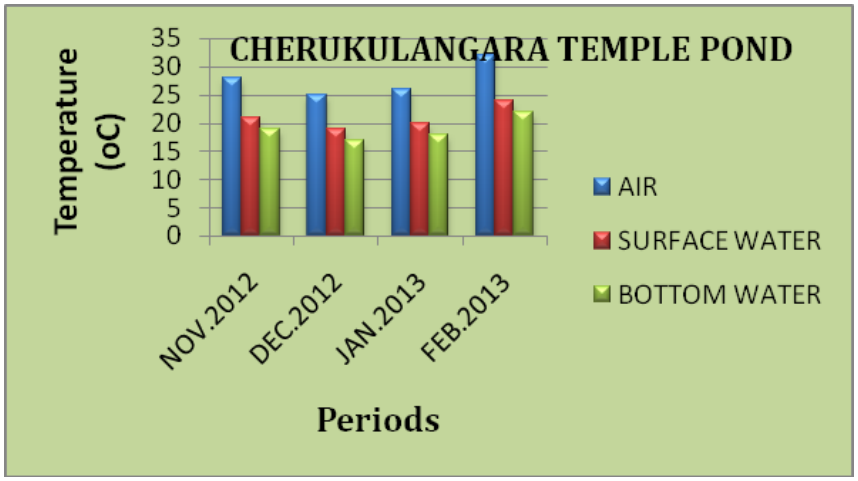

Fig.2.Showing Temperature variation in Pond B

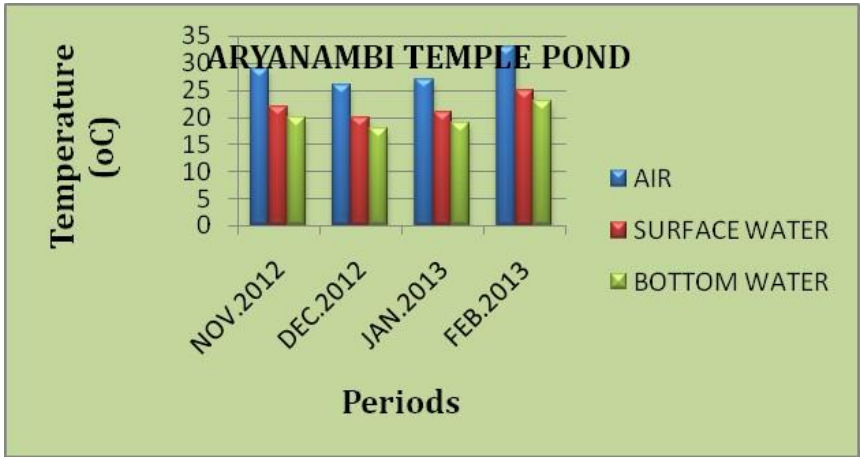

Fig.3.Showing Disssolved oxygen in Pond B

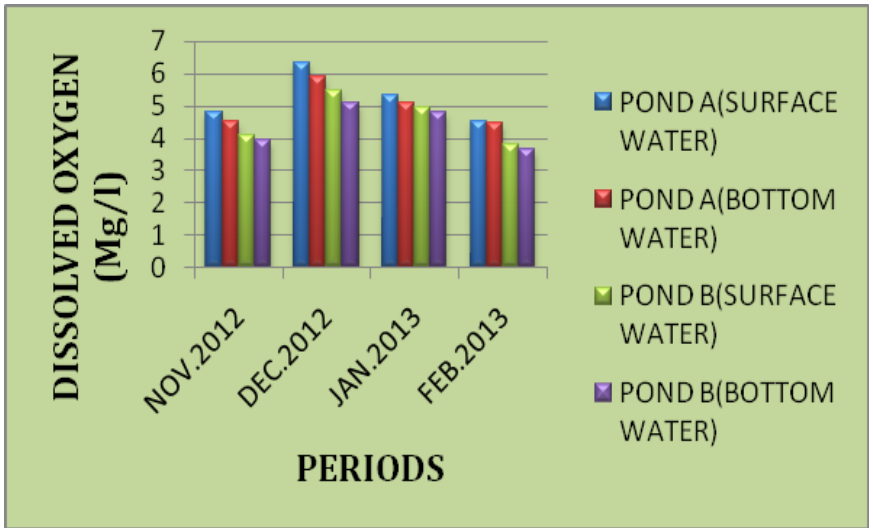

Fig.5. pH in Pond A and B

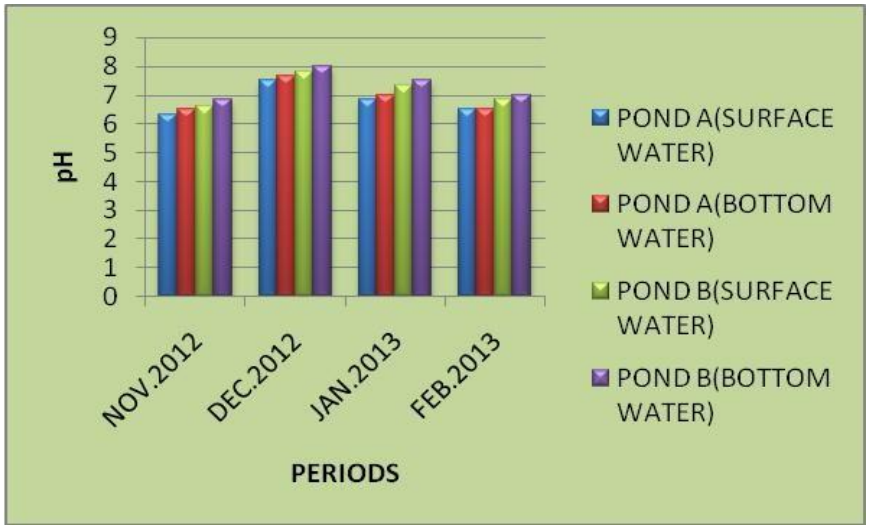

Fig.4.Total solids in Pond A and B

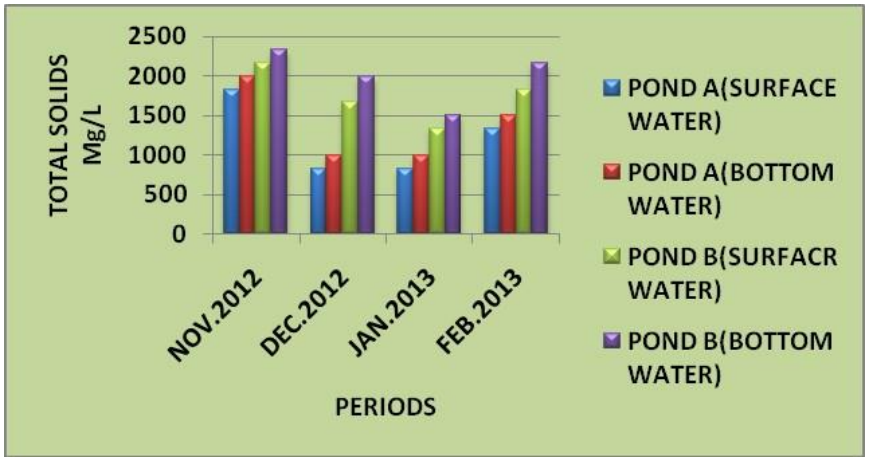

Fig.6.Dissolved carbondioxide in Pond A and B

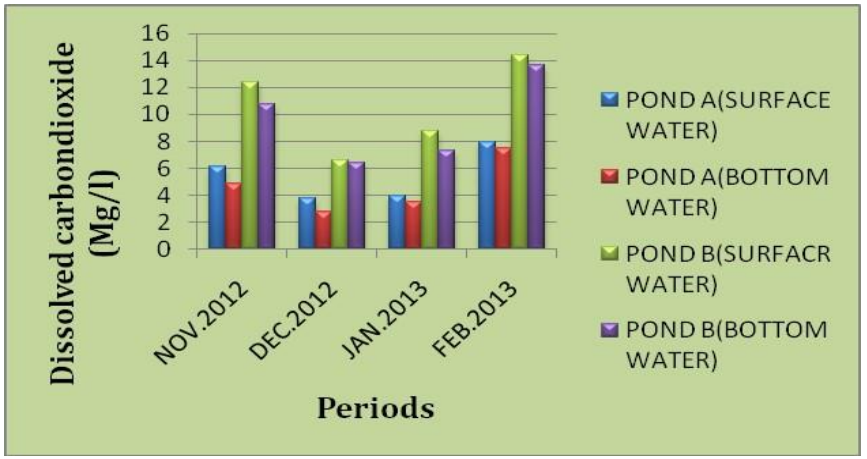

Fig.7.Bicarbonate in Pond A and B

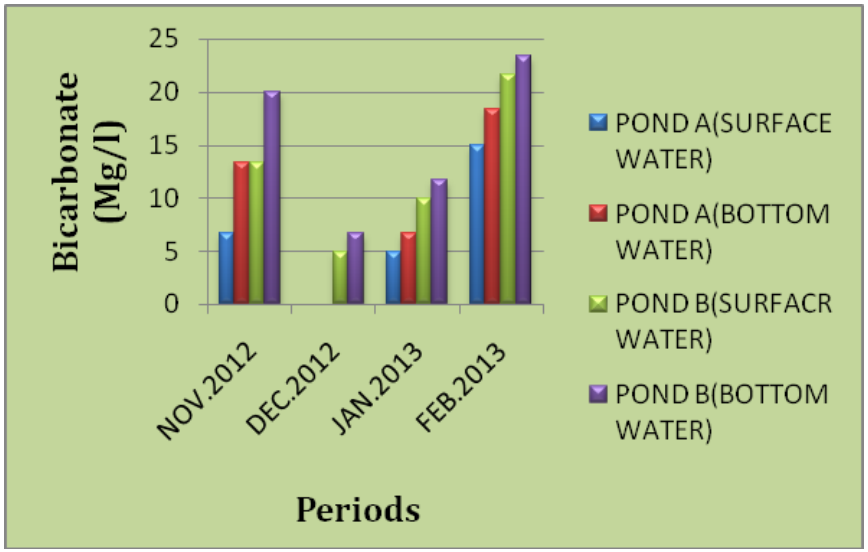

Fig.8.Calcium in Pond A and B

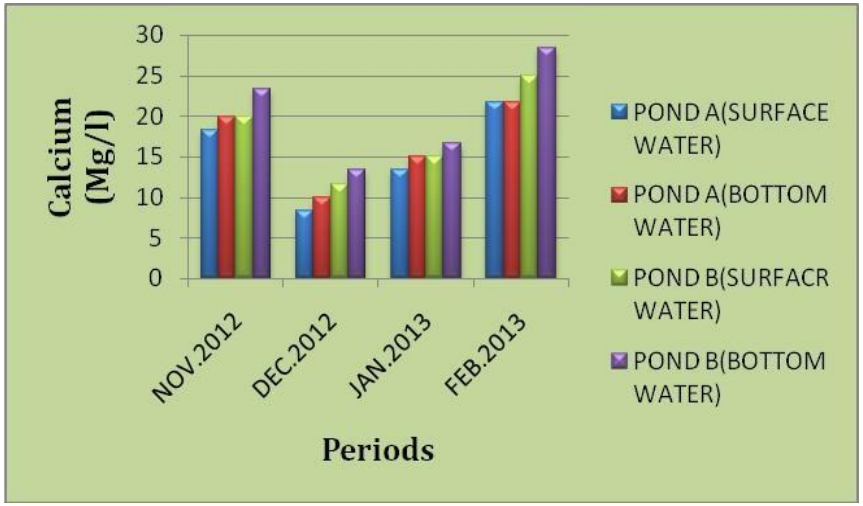

Fig.9.Phosphate in Pond A and B

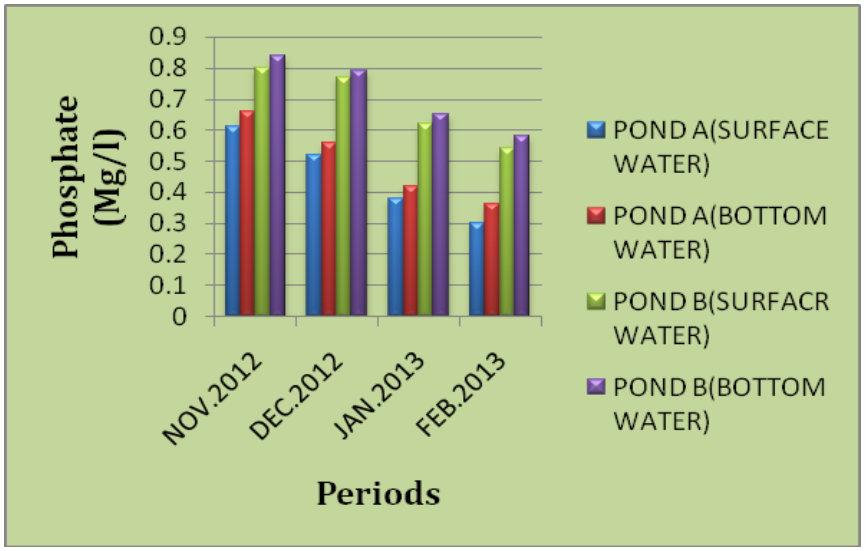

Fig.10.Magnesium in Pond A and B

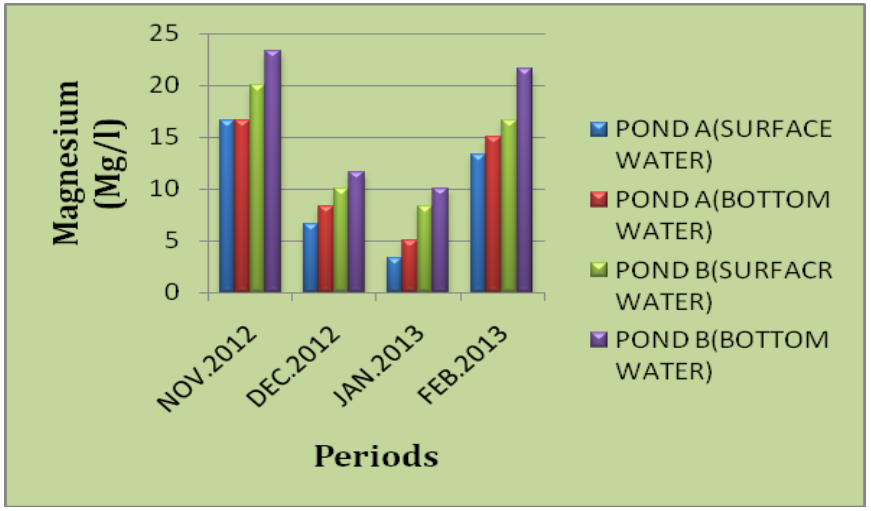

Fig.11.Chloride in Pond A and B

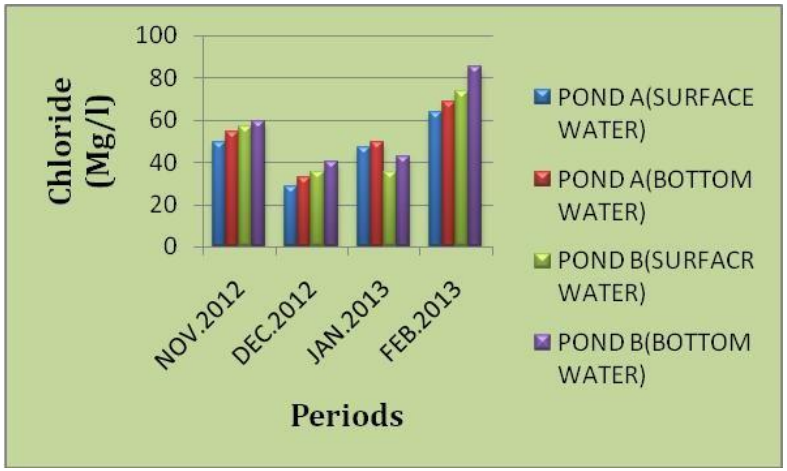

Fig.12.Sulphate in Pond A and B

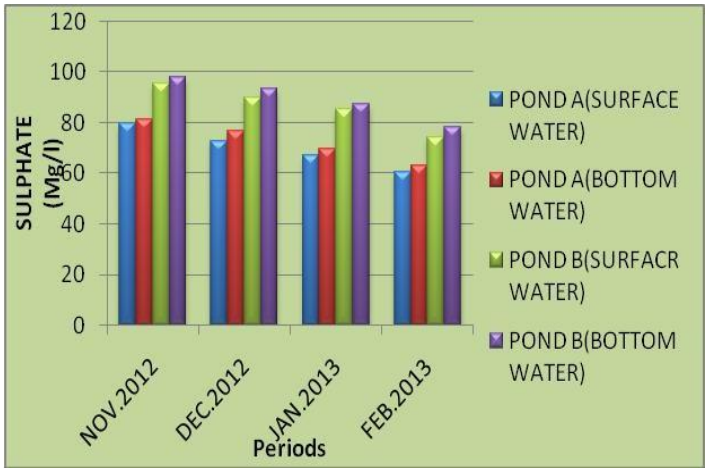

Fig.13.Nitrate in Pond A and B