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ENVIRONMENTAL IMPACT OF SINGANALLUR LAKE WATER

Babu.A* , Dr. N. Balasundaram
* Ph.D Scholar, Department of Civil Engineering, Karpagam University, Coimbatore, India.
Professor, Department of Civil Engineering, Karpagam University, Coimbatore, India.

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ABSTRACT

Quality of the water was monitored by analyzing both physico chemical parameters and heavy metals in water of Singanallur lake Coimbatore, Southern India during October 2015 to May 2016. Heavy metals like Cadmium, Chromium, Copper, Lead, Nickel, Iron and Zinc were detected in water. Another aim of the study was to find out whether any relationship was exists between heavy metals and physico chemical parameters by made up of a correlation profile. Water samples were collected from 3 locations and one well also of the lake and analyzed for physico chemical parameters. Heavy metals were analyzed by using an Inductively Coupled Plasma Optical Emission Spectroscopy (ICP – OES). Have to observe significant seasonal variations in pH, EC, DO, TDS, Temperature, Alkalinity, Hardness, Calcium, Sodium, Sulphate and BOD. The cluster dendrogram of Singanallur Lake revealed that among four seasons, there are three distinct clusters were formed. Discriminant analysis resulted into seven water quality parameters viz., Turbidity, Temperature, TDS, Alkalinity, Sodium, Nitrate and BOD were explaining the seasonal variation in water quality of Singanallur Lake.

KEYWORDS: physico chemical parameters, heavy metals, water quality

INTRODUCTION

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants. Therefore it is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases. It is difficult to understand the biological phenomenon fully because the chemistry of water revels much about the metabolism of the ecosystem and explain the general hydro -biological relationship (Basavaraja Simpi et al. 2011).

STUDY AREA

Singanallur Lake

Singanallur Lake is one of the 9th large lakes in the city & diverse species of birds such as teals, sandpipers, plovers, storks, pelicans, ibis and terns visit Coimbatore wetlands every year. Coimbatore city is fortunate to have many wetlands but most of them are highly polluted and the Singanallur Lake is considered to be the most polluted in the region has grown to be a welcome abode for winged visitors. Another study by Indian Institute of Sciences, Bangalore, on diatom (unicellular algae) based pollution monitoring in urban wetlands of Coimbatore (2009) found 96 species of diatoms belonging to 34 genera. These diatom assemblages indicated Vedapatti, Perur and Sundakkamuthur as moderately polluted while Pallapalayam, Noyyal and Singanallur wetlands are heavily polluted.Recent toxicological study done by a set of school students and presented at the National Children's Science Congress (2009) showed lower turbidity and higher pH, dissolved solids, alkalinity, biological oxygen demand, chemical oxygen demand, calcium, magnesium etc. Genotoxicity studies done in the last 10 years have established even DNA damage to the fish and tadpoles found in the Noyyal River.

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The Singanallur Lake is fed by two canals namely, Sanganur canal & Udayampalayam. Singanallur Canal starts from foothills near Thadagam area and sewage is discharged into the canal. Other canal Starts near Udayampalayam area, sewage is discharged into it by the people settled in the catchment area. The quantum of sewage flowing into the lake is approximated to be around 10 MLD from Sanganur Canal, 5 MLD from other canal. Approximately 10 to 15 MLD of sewage may be following into the lake & it shall be measured by scientific means.

The lake can be restored from the pollution by avoiding the entry of polluted streams or by treating the sewage Waste. Sewage Discharge from Industries & Hospitals has to be assessed & prevented.

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Fig 1 : Singanallur Lake

The Characteristics To Be Studied Are:

pH, Electrical Conductivity (E.C), Total Solids (TS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Total Hardness, Calcium Hardness, Magnesium Hardness, Nitrates, Phosphates, Sulphates, Chlorides, Dissolved Oxygen (D.O), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Fluorides, Free Carbon-di-oxide, Potassium and Sodium.

Water Treatment Technologies are,

- Activated Sludge Process
- Extended Aeration Process
- Moving Bed Bio Reactor
- Sequential Batch Reactor
- Membrane Bio Reactor
- The data for the quantity & quality of sewage, detailed survey & analysis is required for restoring the Singanallur Lake.

AIM OF THE PROJECT

- To analyze Physico-chemical parameters such as (pH), (COD), (B.O.D.), Hardness, (TDS) and (EC). Etc.,
- To asses Physical change in the area; Change detection of land Use/ Cover such as water body, agriculture and dry land.
- To asses environmental impact on Water, human, agriculture and social economic condition of area.
- To propose restoration plan of the lake.
-

METHODOLOGY

Materials and Methods

The water samples are collected from the lake side and conduct some water tests to find a characteristic of water. In this thesis we have collected water samples from the lake subsurface at a depth of about 0.5 m depth and from open well in the nearby area. The samples were kept in ice boxes with frozen gel packs and taken to the laboratory for the Physico chemical parameters of triplicate water samples analysis using the standard methods

WATER SAMPLE – I	-	In Front of Boat House at 2m depth
WATER SAMPLE –II	-	Center Point of Lake at 3 m depth
WATER SAMPLE–III	-	South Side Tile end of Railway Track Bridge at 2.5m depth
WATER SAMPLE – IV	-	Open Well at 3.5m

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WATER SAMPLE – V - Kallimadai bore well at 60m

For metal analysis, about 250ml of water sample was transferred into clean conical flasks and acidified using concentrated nitric acid. The pH of the sample was brought to 2 using 1N nitric acid and was stored till the time of processing. Samples were transferred into beakers and concentrated keeping a hot plate in fume hood adding 12-15ml of analytical grade concentrated nitric acid and adjust the temperature to 105°C. The digestion was continued for minimum two hours and do not let the sample boil.

Add nitric acid until the digestion was complete. The sample became color less and clean. After digestion process, beaker is allowed to cool. Later, the inner walls of beakers were washed with double distilled water and the content was transferred to 50ml volumetric flasks. And the final volume was made up to 50ml and stored in polythene bottles for analysis using an Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES).

Fig 4 : Water Sample

Fig 4 (a) – Sample Collection Location

Fig 4 (b) – Open Well Point

Fig 4 (c) – In front Of Boat House

Fig 4 (d) – Center Point Of Lake

Fig 4 (e) – Tail Point Of Lake

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WATER SAMPLE

Fig 4.1: In Front of Boat House

Fig 4.2: Center of The Lake

Fig 4.3:South Side Tile End of Lake

Fig 4.4: Open Well

Fig 4.5: Kallimadai Bore well Near Singanallur Tank

Fig 4.6: Samples

EXPERIMENTAL ANALYSIS

ANALYSIS OF PHYSICAL, CHEMICAL AND BIOLOGICAL PARAMETERS

The parameters analysed to assess the water quality are broadly divided into:

- Physical parameters: Colour, Temperature, Transparency, Turbidity and Odour.
- Chemical parameters: pH, Electrical Conductivity (E.C), Total Solids (TS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Total Hardness, Calcium Hardness, Magnesium Hardness, Nitrates, Phosphates, Sulphates, Chlorides, Dissolved Oxygen (D.O), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Fluorides, Free Carbon-di-oxide, Potassium and Sodium.
- Heavy metals: Lead, Copper, Nickel, Iron, Chromium, Cadmium and Zinc.
- Biological parameters: The biological parameters involved the qualitative analyses of planktons (zooplankton and phytoplankton).

Field Measurement:

The field parameters measured include pH, conductivity, dissolved oxygen, temperature and transparency.

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PWD – ENVIRONMENTAL WING RESULTS

	2014-2015		2013-2014		2012-2013	
Parameters	Premonsoon	Monsoon	Premonsoon	Monsoon	Premonsoon	Monsoon
PH	8.2	7.7	7.29	7.78	7.28	7.67
EC(µS cm^{-1})	3093	2287	1950	1805	1800	1710
Turbidity(NTU)	13	16	30	35.3	22	26.6
DO (mg/l)	4.8	5.1	5.3	5.1	5	5.5
Temp(°C)	29.2	28.13	27.5	29	26.14	28
TDS(mg/l)	1995	1328	1510	1282	1348	1460
Alkalinity(mg/l)	576.6	447.6	438.3	454	400	470.7
Hardness(mg/l)	730	621	524	497	480	340
Calcium(mg/l)	192.6	163.3	157.3	132	128	116.3
Magnesium(mg/l)	54.3	49.6	52	40	38	32.6
Sodium(mg/l)	312.6	201.3	172.6	165.3	178	166
Potassium(mg/l)	25.6	21.6	22.3	17.6	17	15
Ammonia(mg/l)	2	3.65	2.6	4.3	0.5	0.8
Nitrite(mg/l)	0.1	0.2	0.1	0.04	0.3	0.5
Nitrate(mg/l)	55	35.6	39	38.6	33	31.2
Chloride(mg/l)	506	412	400±38.7	274	280	140
Flouride(mg/l)	1.1	0.9	0.8	0.7	0.6	0.5
Sulphate(mg/l)	147	74.6	69	86.6	121	69.5
Phosphate(mg/l)	1.9	2.6	2.4	3.9	4.53	5.9
BOD(mg/l)	254	141	130	101	106	115
COD(mg/l)	313	355	355	264	283	355

Tab 5.1: Pwd – Environmental Wing Results

SOURCES OF WATER

SIRUVANI WATER - SADIVAYAL POINT

Fig 5.3(a) : Sadivayal Point

As the pH of water is extremely important Physico chemical analysis of the water samples done using standard procedures. The pH values analyzed ranges from 7.5- 10. The Aliyar river water was found to have the highest pH value (9.76±0.2) and the lowest (7.5±0.3) was from Amravati. The fluctuations in optimum pH ranges may lead to an increase or decrease in the toxicity of poisons in water bodies. The pH obtained in the river waters was within the ranges suitable for aquatic life. Based on these guidelines, the pH of the river water would not adversely affect its use for domestic and recreational purposes.

PERUR TOWN POINT

Fig 5.3(b): Perur Town Point

Perur town panchayat is located in Coimbatore district of Tamil Nadu, spread over an area of about 6.4 km^2 on the banks of river Noyyal, 22 km from the place of its origin in the Vellingiri hills. From Perur it passes through seven taluks and covering four districts before it mixes with the river Cauvery. Noyyal River is the maximum polluted one where the discharge of domestic sewage and washing of vehicles, bathing of animals, human activities, releasing of municipal wastes. Hence the study has been carried out to analyze the physicochemical and bacteriological parameters of the Noyyal river water and ground water of the nearby irrigated land in Perur, also to assess the impact of percolation of river water flow on the ground water, irrigation and drinking water sources. The ground water samples were taken from the open and bore wells of the irrigated lands at a depth of 120-150 m height from the ground level. The river water samples were collected in clean sterile plastic containers from three different sites at monthly intervals during the rainy season period from September to November. The samples were transported to the laboratory within 3 hrs for analysis of physico-chemical parameters and bacteriological quality.

The results obtained were moderately alkaline (pH 7.81–8.11) and within the permissible limit (pH 6.5-8.5) of drinking water standards of WHO, 1993. The maximum BOD and COD values were 11.6 mg/l and 23.7 mg/l, respectively in river water. There was a significant degree of self-purification as the river water flows. The mean BOD (9.5 mg/l) and COD (19.2mg/l) of the Noyyal river water were high when compared to ground water samples; it was found one and half times greater than the permissible limit (5mg/l-BOD; 10mg/l–COD).

SINGANALLUR RAILWAY TRACK POINT

In this study, Physico chemical characteristics of water was analysed for Singanallur lake. Maximum temperature was recorded during pre-monsoon season as 29.2±0.34ºC and minimum temperature was recorded during winter season as 27.5±0.17ºC. It was empirically established that higher pH was noticed during.

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Fig 5.3(c): Singanallur Railway Track Point

Pre monsoon season as 8.2 ± 0.03 and lower pH was recorded during winter season as 7.29±0.05.In the present study, higher value of DO was recorded during winter season as 5.3±0.1mg/l lower value was reported during pre-monsoon season as 4.8±0.27mg/l. BOD determination is the most useful technique to assess the level of organic pollution in lake ecosystem (Khanna, 1993). A maximum value of 254± 60mg/l was noted during pre-monsoon season and a minimum of101± 14.7mg/l was noted during summer season. This study witnessed for a high value of COD was recorded during monsoon season as 355± 33.7mg/l and a low value of 264± 27.9mg/l was noticed during summer season. In this study, the maximum TDS of 1995±82.2mg/l was recorded during pre-monsoon season and minimum value of 1282±89.7mg/l was recorded during summer season .This study reveals that maximum value of turbidity as 35.3±1.3NTU was recorded during summer season and minimum value of 13 ±1.2NTU was recorded during pre-monsoon season. Higher value of Electrical Conductivity was recorded during pre-monsoon as 3093 ± 316µmhos/cm and lowest value of EC was recorded during summer season as 1805±105µmhos/cm. Maximum alkalinity was recorded during pre-monsoon season as 576.6±25.6mg/l and minimum value was recorded during winter season as 438.3±30.23mg/l. Total hardness of the Singanallur lake varies from 497 ±34.7mg/l to 730±28.6mg/l. Higher value of hardness was recorded during pre-monsoon and lower value was noticed during summer season.

RESULT ANALYSIS

S.NO	PARAMETERS	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1.	**PH**	7.28	7.42	7.31	7.78	7.58
2.	**Electrical Conductivity**	1813	1715	2134	1908	2345.5
3.	**Turbidity(NTU)**	18.5	27.9	33.5	36.6	0
4.	**Dissolved oxygen (mg/l)**	4.9	4.58	5.4	5.2	5.62
5.	**Temperature(°C)**	25.76	28.6	27.56	28.2	31.25
6.	**Total Dissolved Solids (TDS)**	1200.5	1592.7	1342.9	1486	1642
7.	**Total Alkalinity (mg/l)**	346.2	410.4	470.2	391.4	380
8.	**Hardness (mg/l)**	442.7	328.3	575.4	512.7	660
9.	**Calcium(mg/l)**	112.7	120.6	180.3	142.4	206
10.	**Magnesium(mg/l)**	44.21	28.44	59.1	35.8	37.5
11.	**Sodium(mg/l)**	189.3	191.4	150.2	115.9	182.5

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12.	**Potassium(mg/l)**	15.2	10.5	20.4	19	5
13.	**Ammonia(mg/l)**	1.1	0.4	3.4	5.2	2.63
14.	**Nitrite(mg/l)**	0.5	0.3	0.2	0.04	1.715
15.	**Nitrate(mg/l)**	39.5	29.5	41.24	37.21	41
16.	**Chloride(mg/l)**	242.5	166.8	356.1	310	375
17.	**Fluoride(mg/l)**	0.7	0.4	0.9	0.6	0.9
18.	**Sulphate(mg/l)**	147.2	56.3	76.3	99.4	128.5
19.	**Phosphate(mg/l)**	4.42	6.1	2.6	3.3	1.785
20.	**BOD(mg/l)**	113.4	100.8	145.6	90.7	145
21.	**COD(mg/l)**	310.4	390.5	355 .32	264.27	375

Tab: 5.4 – Result Analysis

RESULT COMPARISION

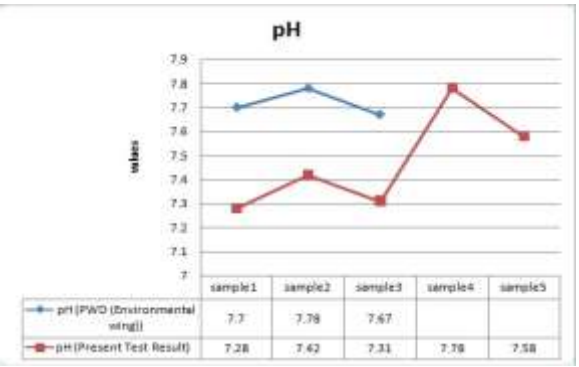

Chart 5.4(a) – pH value is reduced

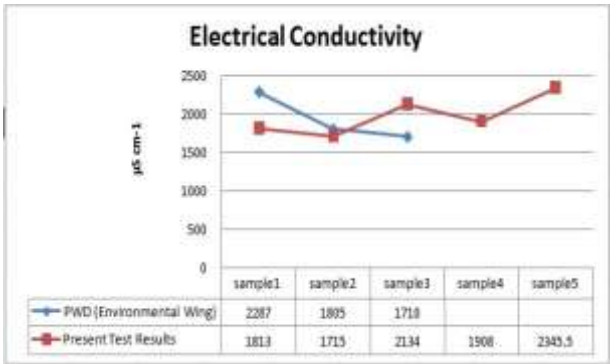

Chart 5.4(b) – Electrical Conductivity is increased

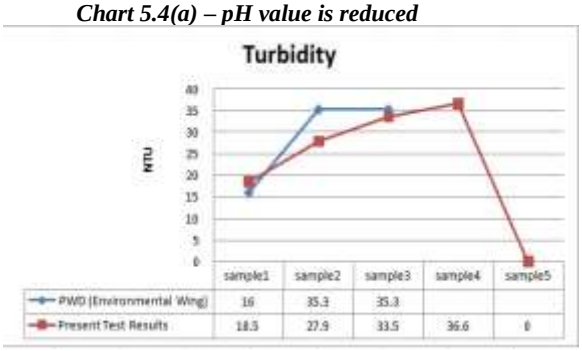

Chart 5.4(c) – Turbidity is decreased

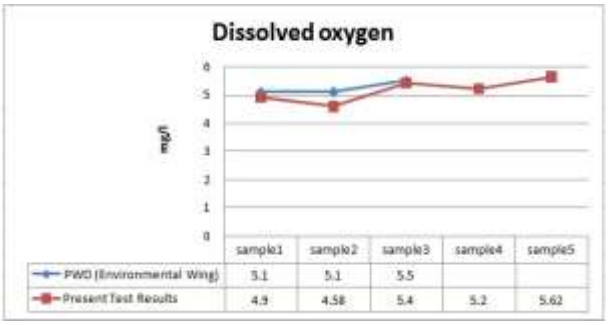

Chart 5.4(d) – Dissolved Oxygen is moderate

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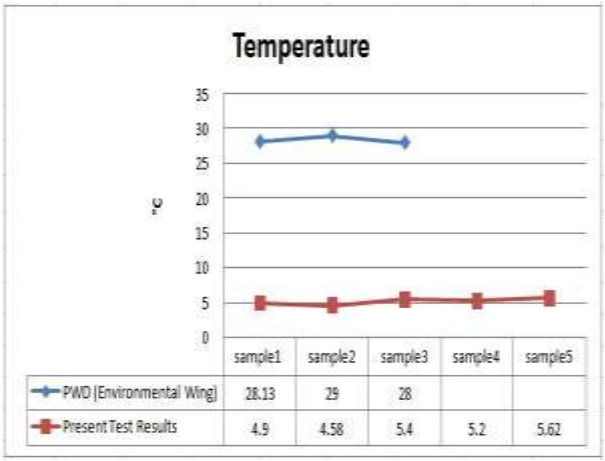

Chart 5.4(e) – Temperature is very Low

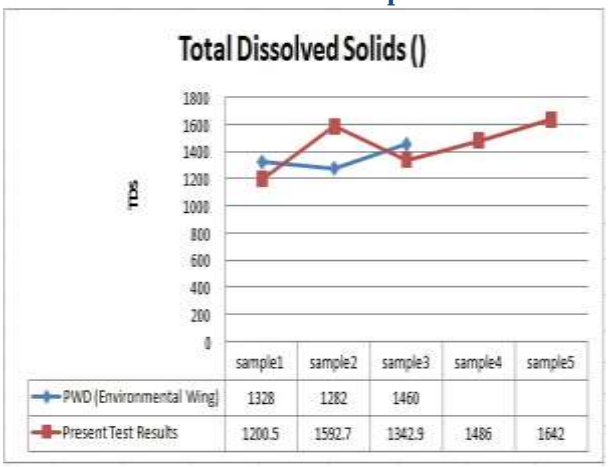

Chart 5.4(f) – Total Dissolved Solids is increased

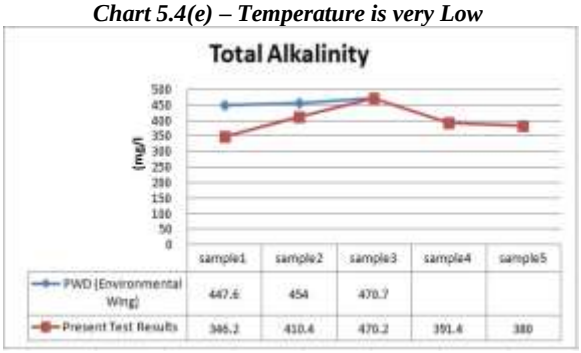

Chart 5.4(g) – Total Alkalinity is decreased

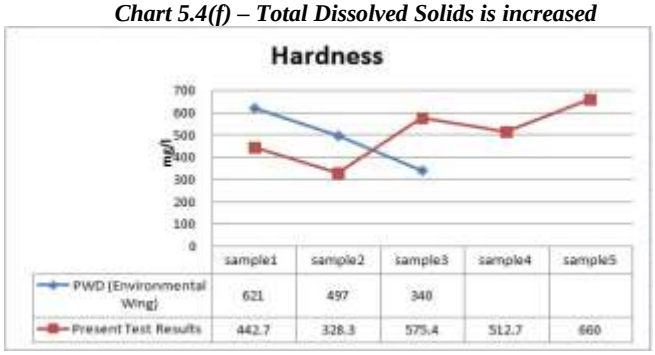

Chart 5.4(h) – Hardness is increased

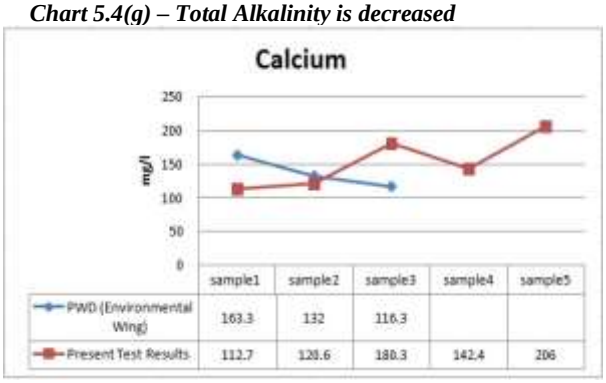

Chart 5.4(i) – Calcium is increased

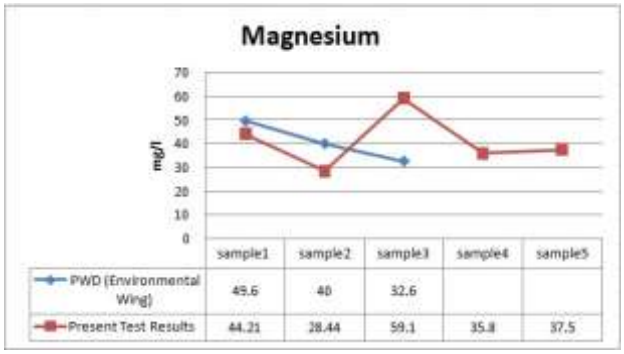

Chart 5.4(j) – Magnesium is decreased

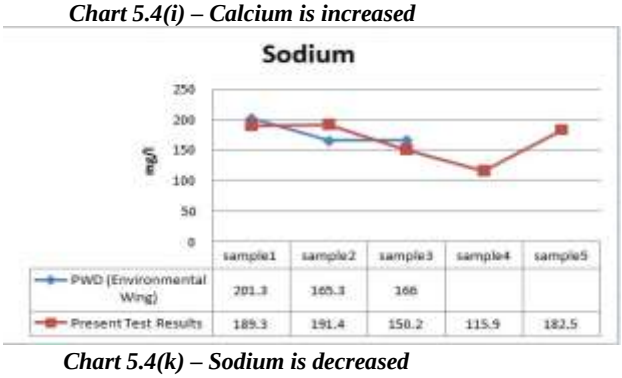

Chart 5.4(k) – Sodium is decreased

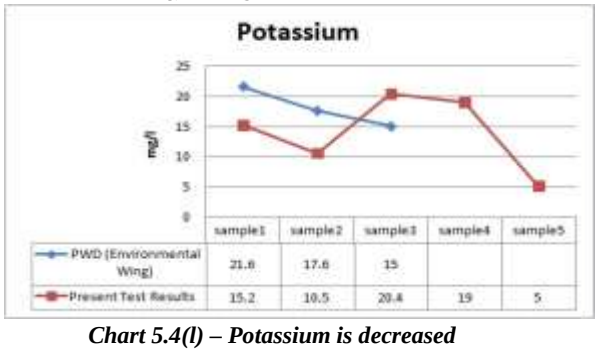

Chart 5.4(l) – Potassium is decreased

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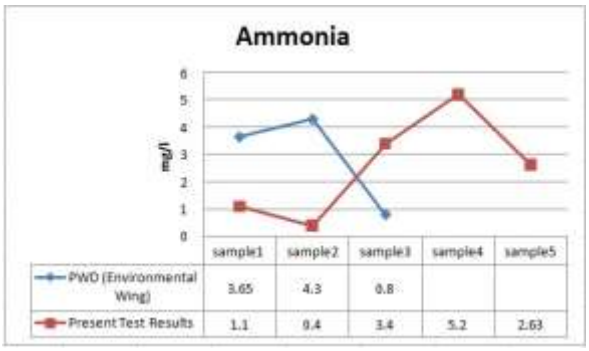

Chart 5.4 (m) – Ammonia is increased

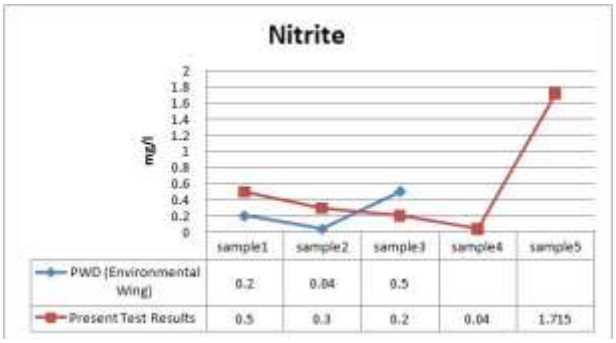

Chart 5.4(n) – Nitrite is decreased

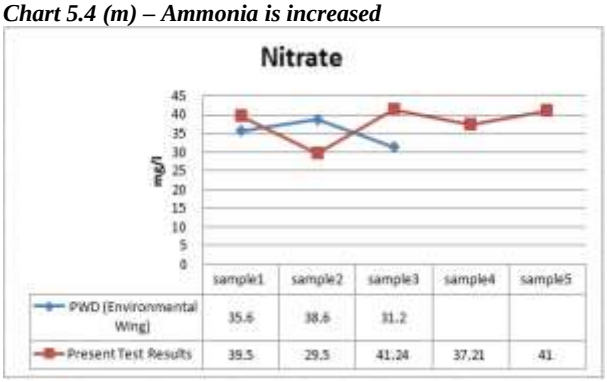

Chart 5.4(o) – Nitrate is increased

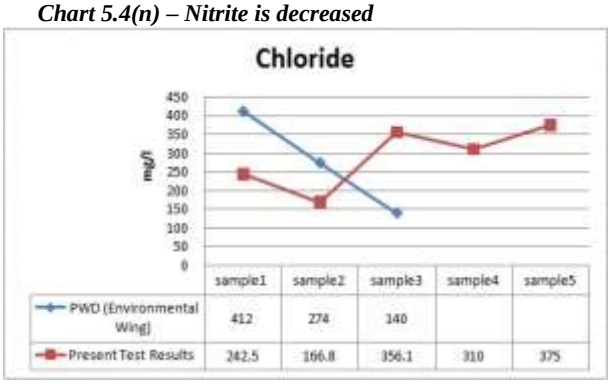

Chart 5.4(p) – Chloride is increased

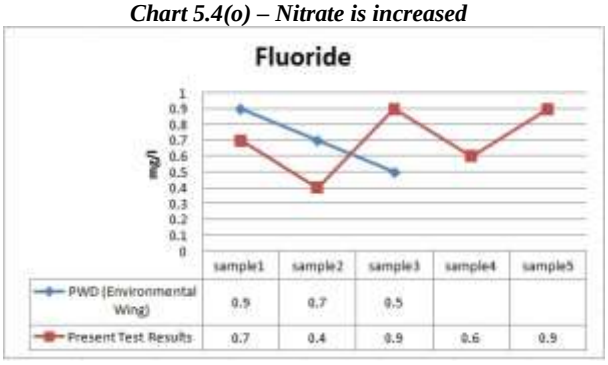

Chart 5.4(q) – Fluoride is increased

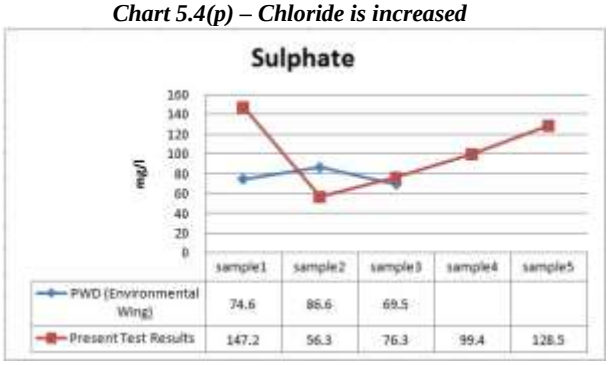

Chart 5.4(r) – Sulphate is increased

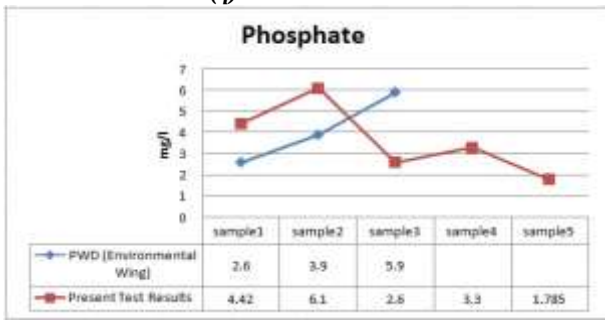

Chart 5. 4(q) – Phosphate is decreased

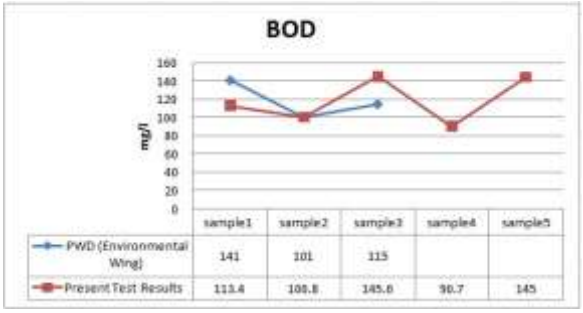

Chart 5.4(t) – BOD is decreased

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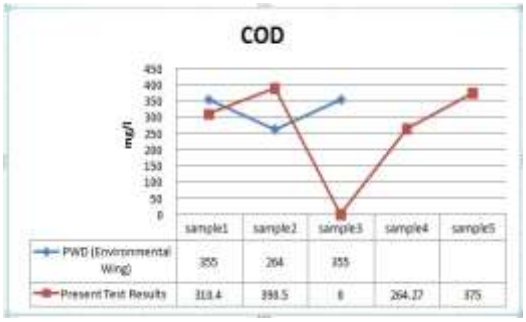

Chart 5.4(u) – COD is decreased

CONCLUSION

- The present investigations conclude that the quality of water samples subjected to study on various aspects and the collected sample water from the various locations was tested and compared with the PWD Environmental Ring. By comparing the test results the Singanallur Lake is the most polluted one which gives a clear idea about the environmental impacts of Singanallur Lake, in addition, 90% of the infectious diseases may transmitted from polluted water. During the Sample collection, the maximum pH value is 7.78 and the minimum is 7.28 which are about changes due to air and temperature.
  From the result analysis the parameters of water samples shows the usage of recycled water for various purpose. By the following recommended process the recycled water can be used for the several purposes and avoid depleting natural resources and unplanned changes of land used.
  - The Activated Sludge Process is a process for treating sewage and industrial wastewaters using air and a biological floc.
  - Extended Aeration is a method of sewage treatment using modified activated sludge procedures.
  - A Bioreactor may refer to any manufactured or engineered device or system that supports a biologically active environment.
  - Sequencing Batch Reactor here the inlet valve opens and the tank is being filled in, while mixing is provided by mechanical means (no air). This stage is also called the anoxic stage.
  - Membrane bioreactor processes can produce effluent of high quality enough to be discharged to coastal, surface or brackish waterways or to be reclaimed for urban irrigation. .
- The major defects may occur if the water is polluted and it may also cause a serious trouble to the environment. Hence the government can follow the process to avoid pollution.

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