An Experimental Analysis on Groundwater samples near Perundurai, Erode District, Tamil Nadu, India

Senthamilselvi P[1], Abirami S[2], Praveen kumar S[3] , Priyanga R[4] , Ragupathi K[5]
[1]Assistant Professor, Dept of Civil Engineering
[2, 3, 4, 5]Dept of Civil Engineering
[1, 2, 3, 4, 5] Government college of Engineering, Salem, Tamil Nadu, India – 636011.

Abstract- *This study was carried out to assess the impacts of industrial activities on the ground water quality around SIPCOT Industrial complex, Perundurai of Erode District in Tamil Nadu. The quality was assessed in terms of physicochemical parameters. Ground water samples were collected from eight (8) different locations in Perundurai around SIPCOT industries in different directions (Grouped under East, North and South) during January 2020. The physico-chemical parameters such as pH, Total dissolved solids (TDS), Turbidity, Dissolved oxygen (DO), Total alkalinity, Total hardness, Permanent Hardness, Temporary Hardness, Chloride (Cl -), Sulphate (SO42-) were analyzed to know the present status of the bore well water quality. The results were compared with standards prescribed by IS 10500-2012. It was found that the underground water was highly contaminated at South direction and partially at North direction. The sampling site in East direction shows most of the physicochemical parameters near to the water quality standards and further increase in distance of sampling, the quality of water is good for drinking purpose.*

Keywords- Groundwater, Physico-chemical characteristics, Industry, water quality, SIPCOT.

I. INTRODUCTION

For the survival of life and healthy living Water is most of the basic elements on the earth. Groundwater is the most fundamental and suitable freshwater resource. According to physicochemical and microbiological characteristics of water, the quality may be described. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization. Groundwater is very difficult to remediate, except in small defined areas and therefore the emphasis has to be on prevention. So the knowledge of extent of pollution and the status of water become essential in order to preserve the valuable source of water for future generation is directly linked with human welfare. Water pollution is a serious threat that affects water quality, human health, economic development, and social well-being. Therefore, it is essential to evaluate groundwater quality at regular intervals and creating a database for future water resources development strategies.

II. METHODOLOGY

2.1 STUDY AREA

Perundurai is a Panchayat town in Erode district in Tamil Nadu .Perundurai has developed as the Industrial centre with SIPCOT industrial Estate as it is the Asia's second largest SIPCOT. Its coordinates are 11.27˚N and 77.58˚ E with an elevation of 292 m from sea level.

2.2 SAMPLE COLLECTION

Water samples are collected from 8 different places around SIPCOT industries in different directions (Grouped under East, North and South) during January 2020. The samples were collected in 5 liters polyethylene bottles and are named as S1, S2 upto S8. The Samples S1, S2, S3 are collected at 1km radius in North direction and grouped as A1. The S4, S5, S6 are collected at 3km radius in East direction and grouped as A2. The S7, S8 are collected at 5km radius in South direction and grouped as A3.

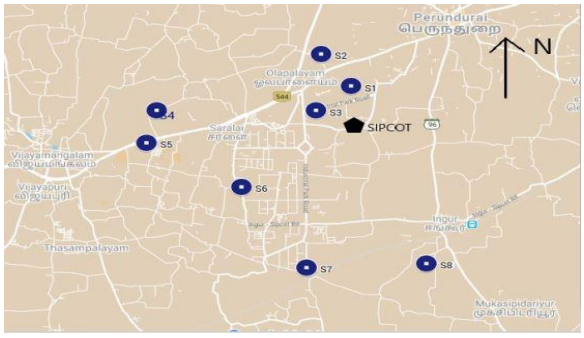


Image 1 – Location of samples

2.3 PHYSICO-CHEMICAL ANALYSIS

The collected samples were analysed for major physical and chemical water quality parameter like pH, Total dissolved solids (TDS), Turbidity, Dissolved oxygen (DO), Total alkalinity, Total hardness, Permanent Hardness, Temporary Hardness, Chloride (Cl^-), Sulphate (SO_4^{2-}) were carried out referring the Indian Standards 3025 . The quality of ground water has been assessed by comparing each parameter with the standard desirable limit of that parameter in drinking water as prescribed by ISI 10500-2012.

III. RESULTS AND DISCUSSION

The results of the physicochemical analysis of the groundwater samples S1 to S8, collected from 8 places around Perundurai are presented in Table 1.

Table 1 – Average values of test results.

Experiments	Acceptable limit as per IS10500-2012	At 1 Km Radius	At 3 Km Radius	At 5 Km Radius
pH Range	6.5 to 8.5	7.61	7.21	7.58
Turbidity (NTU)	1	7.67	7	7
Alkalinity (mg/lit)	200	495	293.33	531
Temporary Hardness (ppm)	200	32.67	27	59.5
Permanent Hardness (ppm)	350	752.33	436.67	697
Total Hardness (ppm)	550	785	463.67	756.5
Chlorides (mg/lit)	250	455.52	242.92	507.84
Sulphates (mg/lit)	200	317	259.25	256.09
Dissolved Oxygen (mg/lit)	4 to 6	4.88	5.55	3.5
Total Solids (mg/l)	500	2554	1086.67	2180
Dissolved Solids (mg/l)	100	1585.33	1013.33	2066
Suspended Solids (mg/l)	500	967.33	73.33	100
Organic Solids (mg/l)		105.33	45.33	110

3.1 pH

pH is considered as an important ecological factor and provides an important piece factor and piece of information in many types of geochemical equilibrium or solubility calculation. The pH values fluctuated between 7.02 to 7.9 (Table 1). The limit of pH value for drinking water is specified as 6.5 to 8.5 according to IS 10500-2012. The pH shows slightly alkaline trend. Hence, these samples are tends to be safe in pH.

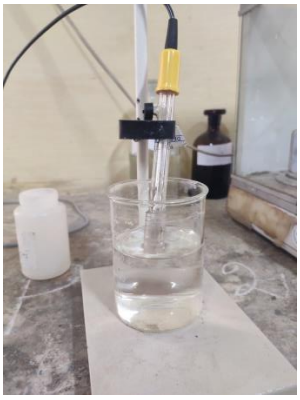
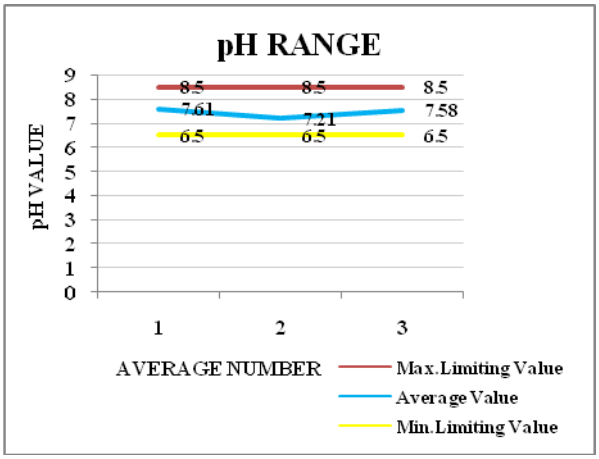


Image 2- Testing of Ph

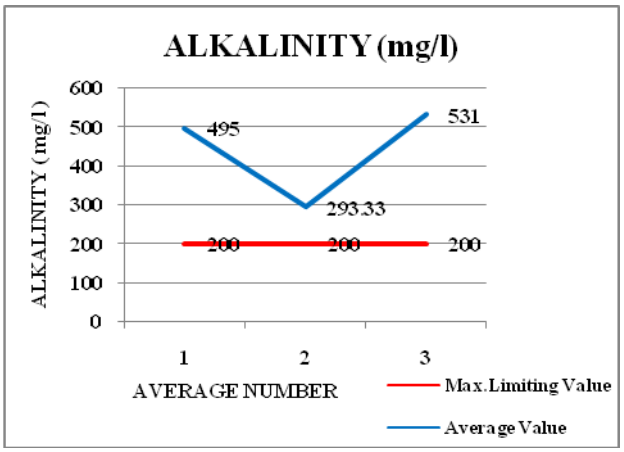


Graph 1 – pH values of average samples.

3.2 ALKALINITY

Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and potassium. The alkalinity values fluctuated between 139 mg/l to 541 mg/l (Table 1). The limit of alkalinity value for drinking water is specified as 200mg/l according to IS 10500-2012.Total alkalinity values for the investigated samples were found to be greater than the value prescribed except the samples S6. The Southern side samples (A3) are highly affected due to alkalinity.

Image 3 – Testing of Alkalinity



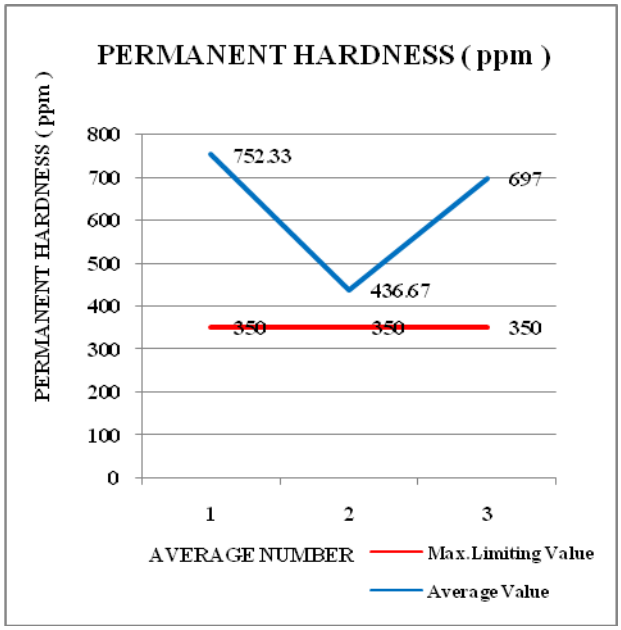
Graph 2 – Alkalinity values of average samples.

3.3 TOTAL HARDNESS

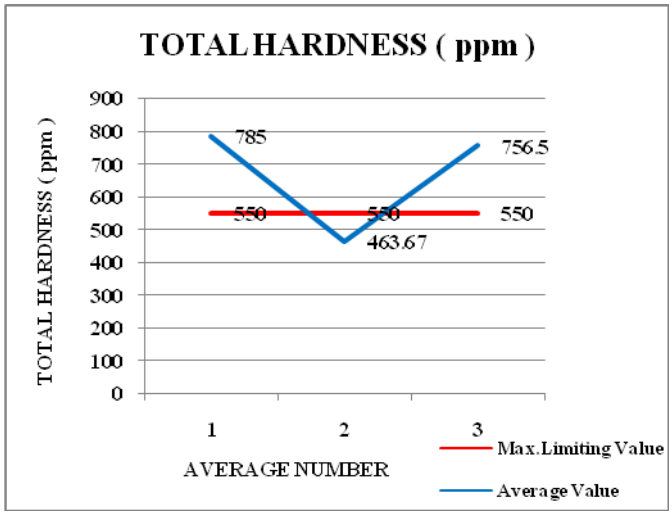
Total hardness (TH) Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. The hardness values shown range from 457 ppm to 896 ppm. The limit of alkalinity value for drinking water is specified as 550 ppm according to IS 10500-2012.

The values for bore well sample S4, S5, S6 are lower than the acceptable limit. Hence the samples at western side (A2) are safe. The values at North and South directions are higher than acceptable limit.

Image 4 – Testing of Hardness



Graph 3 – Permanent Hardness values of average samples.

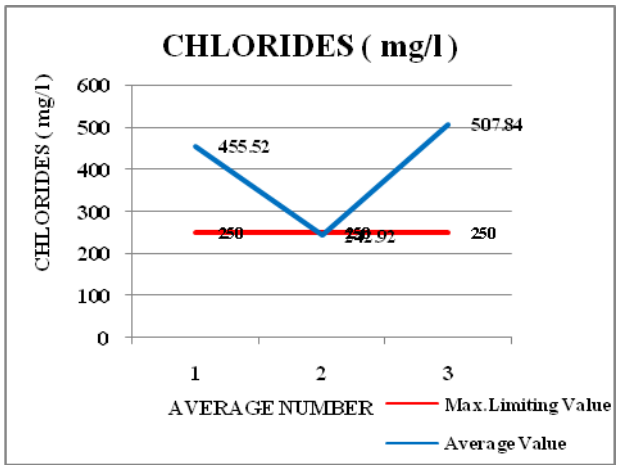


Graph 4 – Total Hardness values of average samples.

3.4 CHLORIDE (Cl^-)

Chlorides are important in detecting the contamination of ground water by waste water. Therefore, its concentration is high in groundwater, where the temperature is high and rainfall is less. Soil porosity and permeability also has a key role in building up the chloride concentration .The permissible limit of chloride in drinking water is 250 mg/l. The values of chlorides in the samples ranges from 91.47 mg/l to 641.3 mg/l. The presence of chloride is slightly higher amounts in S 3 may be due to natural processes such as the passage of water through natural salt formations in the earth or it may be an indication of pollution from industrial use. The average values at Southern direction are higher compared to other samples.

Image 5 – Testing of Chlorides

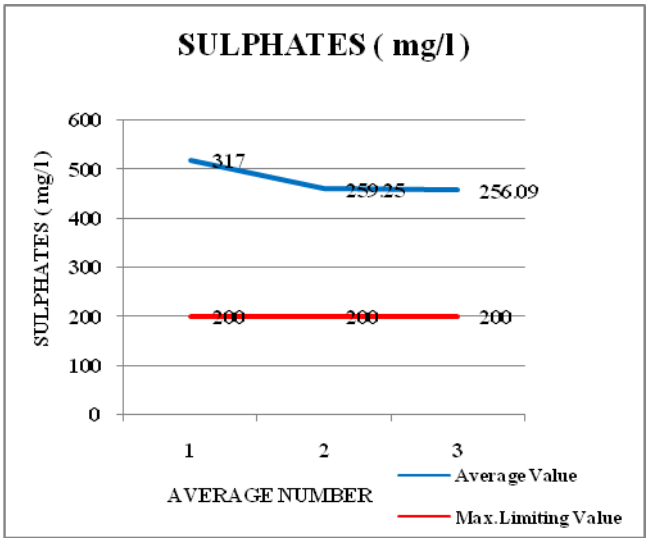


Graph 5 – Chlorides values of average samples.

3.5 SULPHATE (SO_4^{2-})

Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals. Discharge of industrial wastes and domestic sewage tends to increase its

Image 6 – Testing of Sulphates



Graph 6 – Sulphates values of average samples.

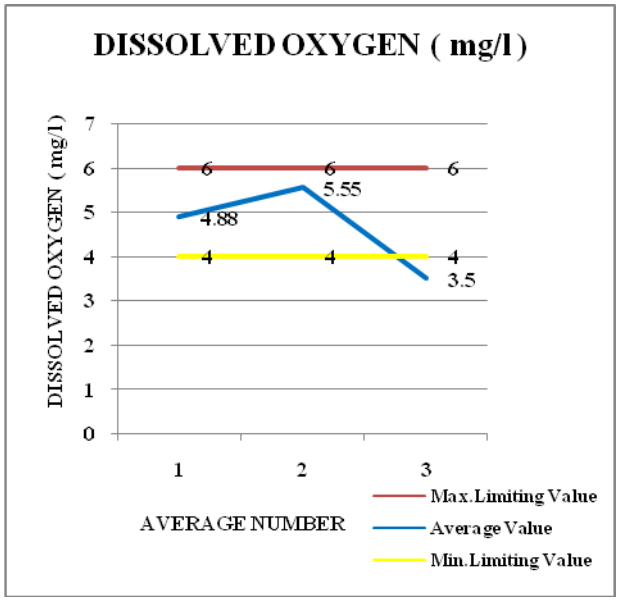
concentration. The permissible limit of sulphates in drinking water is 200 mg/l. The value of sulphates in the samples ranges from 173.1 mg/l to 371.72 mg/l. The samples S5, S8 are within the acceptable limit and all other samples are affected with high sulphates compared with acceptable limit.

3.6 DISSOLVED OXYGEN (DO)

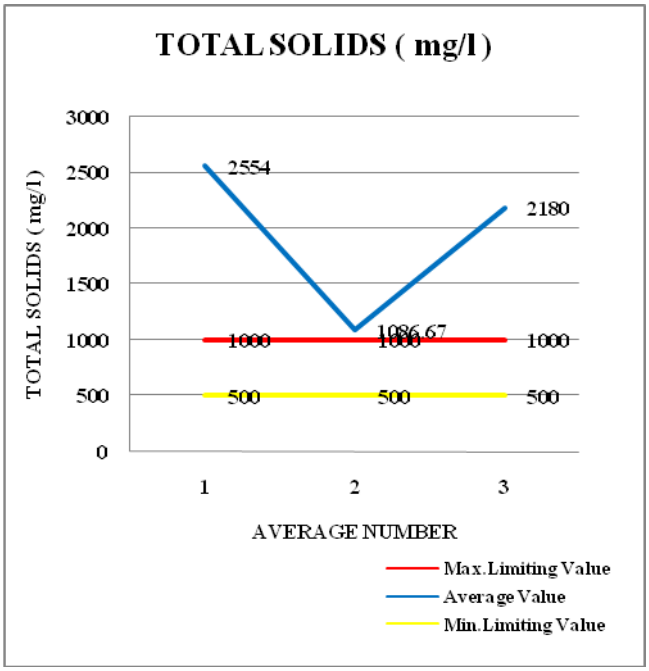
Dissolved oxygen is important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water. The DO values indicate the degree of pollution in water bodies. The permissible limit of DO in drinking water is 4-6 mg /l. DO values varied from 3 to7 mg/l. The samples S7 showed slightly low DO indicating the contamination by organic matter. The Sample S5 shows high value of DO. The remaining samples are within the permissible limit.

Image 7 – Testing of Dissolved oxygen

Image 8 – Testing of TDS



Graph 7 – Dissolved Oxygen values of average samples.



Graph 8 - Total Solids of average samples.

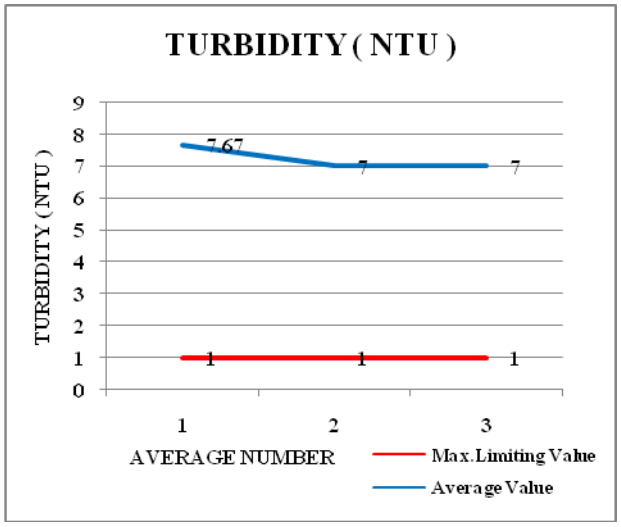
3.7 TDS

Total dissolved solid is a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro granular suspended form. The permissible limit of TDS in drinking water is 500 mg/l. The TDS values in sample water varied from 680 to 4580 mg/l. The value of TDS is higher in all samples compared to the acceptable limit. The high value in sample S3 indicates high ground water percolation of solids in that region.

3.8 TURBIDITY

Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The permissible limit of turbidity in drinking water is 1 NTU. The Turbidity values in sample water are above 7 NTU which may be due to formation of silt or chemicals present in the water.

Image 9 – Testing of Turbidity



Graph 9- Turbidity of average samples.

IV. CONCLUSION

By our testing experiments, it is observed that the quality of the ground water samples from the north side(about 1km) and south side(about 5kms) were mostly affected and the samples at longer distances from south direction is mostly polluted which means that at nearer distance the samples are highly polluted. The samples from the west direction (about 3 kms) were comparatively safe at this distance and with further increase in distance the water samples will be safe and within the Permissible limit for drinking purpose as per IS 10500-2012.

REFERENCES

[1] Ramakrishnaiah C.R. et al, Assessment of Water Quality Index for the Groundwater in Tumkur Taluk, Karnataka State, India, E-Journal of Chemistry 2009, 6(2), 523-530.

[2] ISI, Indian Standard specification for drinking water, IS10500, ISI, New Delhi, 2012 .

[3] Acharya, G.D., Hathi, M.V., Patel, A.D. and Parmar, K.C. 2008. Chemical properties of groundwater in Bhiloda Taluka Region, North Gujarat, India. E-Journal of Chemistry, Vol. 5, No. 4, pp. 792-796

[4] Saravanakumar, K. and Kumar, R.R. 2011. Analysis of water quality parameters of groundwater near Ambattur Industrial Area, TamilNadu, India. Indian Journal of Science and Technology, Vol. 4, No. 5, pp. 560-562

[5] Shyamala, R., Shanthi, M. and Lalitha, P.2008. Physicochemical analysis of borewell water samples of Telungupalayam area in Coimbatore District, Tamilnadu, India. E-Journal of chemistry, Vol.5, No.4, pp.924-929.

[6] Code For Practice,

a) **pH** – IS 3025(Part 2)-1983- Methods of sampling and test (Physical and Chemical) for Water and Waste water.

b) **Turbidity** - IS 3025(Part 4)-1983-Methods of sampling and test (Physical and Chemical) for Water and Waste water.

c) **Alkalinity** – IS 3025(Part 23)-1986-Methods of sampling and test (Physical and Chemical) for Water and Wastewater.

d) **Hardness** – IS 3025(Part 21)-1986- Methods of sampling and test (Physical and Chemical) for Water and Wastewater.

e) **Chlorides** – IS 3025(Part 32)-1988- Methods of sampling and test (Physical and Chemical) for Water and Wastewater.

f) **Sulphates** – IS 3025(Part 24)-1986- Methods of sampling and test (Physical and Chemical) for Water and Wastewater.

g) **Total Solids** – IS 3025(Part 15)-1984- Methods of sampling and test (Physical and Chemical) for Water and Wastewater.

h) **Dissolved Oxygen** – IS 3025(Part 44)-1993- Methods of sampling and test (Physical and Chemical) for Water and Wastewater.