

Evaluation of Drinking Water Quality Parameter from Dindigul Surroundings

C. Kavitha¹, G.N. Kousalya²

Assistant Professor, Department of Chemistry, Parvathy's Arts and Science College, Dindigul, India¹

Associate Professor, Department of Chemistry, G.T.N. Arts College, Dindigul, India²

ABSTRACT: The present study is focused on the determination of physico-chemical parameters, such as temperature, pH, EC, hardness, chlorides, alkalinity, DO, BOD, COD, phosphate and sulphate of water samples from different sampling points. Increase of pollution concentration indicates an increase in the pollution load due to domestic sewage. About 75% of water pollution is caused by domestic wastes and sewage. It includes kitchen wastes, soap detergent, garden waste, human excreta, garbage etc. Thus sewage and domestic wastes are found to contain decomposable oxygen matter as well as trace amounts of toxic metals. In the present study water samples were collected from the whole city was divided in four regions for well-organized sampling and interpretation. The results revealed that the average pH value was analyzed as 7.09 and 7.81, Electrical Conductivity was 1950 $\mu\text{S}/\text{cm}-1$, parameters include Total Dissolved Solids 1326 mg/l, total hardness was 464 mg/l, chloride was 262 mg/l, phosphate was 0.10 mg/l and sulphate was 59 mg/l of the water sample. Therefore the study revealed that how the ground water is contaminated by effluents from small scale industries and dumping of wastages from markets and domestic use wastages. So water quality management is urgently required to achieve the water quality standards determined by World Health Organisation.

KEYWORDS: Bore well water, Total dissolved solids, physico-chemical, Domestic waste.

I. INTRODUCTION

Water is a universal solvent and it is an indispensable natural resource on this earth which makes all life, survive. About 97% of earth's surface is covered by water. Out of which only 3% is fresh water and from which less than 1% for drinking purpose. The quality of ground water depends on various chemical constituents and their concentration, which are mostly derived from the geological data of the particular region. Ground water occurs in weathered portion, along the joints and fractures of the rocks. In fact, industrial waste and the municipal solid waste have emerged as one of the leading cause of pollution of surface and ground water. In many parts of the country available water is rendered non-potable because of the presence of heavy metal in excess. The situation gets worsened during the summer season due to water scarcity and rain water discharge. Water resources are contaminated drinking purposes with heavy elements. In many parts of the country, metal ions and harmful microorganisms is one of the serious major health problems. The recent research in Haryana concluded that it is the high rate of exploration then its recharging, in appropriate dumping of solid and liquid wastes, lack of strict enforcement of law and loose governance are the cause of deterioration of ground water quality. Thus there is a need to look for some useful indicators, both chemical and physical, which can be used to monitor both drinking water operation and performance. The water supply for human consumption is often directly sourced from ground water without biochemical treatment and the level of pollution has become a cause for major concern. The water used for drinking purpose should be free from toxic elements, living and non living organisms and excessive amount of minerals that may be harmful to health. It is highly essential to examine the presence of toxic substances in distribution water for potable purpose before it is used for drinking.

II. METHODOLOGY

Surface water samples were collected from ground water located at city Dindigul. Five locations comprise of many of drains the majority of their effluents into the ground without proper effluent treatment. Besides, the water resource was used for domestic purposes. Water samples from all the sites were collected in sterile glass bottles, brought to the laboratory, processed within 1-3 hrs, and stored at -20°C for further analysis.

1.1. Physicochemical analysis

The physico-chemical properties were studied. Total dissolved solid (TDS) of water and fixed residue was measured by evaporation method. Dissolved oxygen (DO) and biochemical oxygen demand (BOD) of water was measured by sodium thiosulphate titration method. Chemical oxygen demand (COD) was measured by titration of potassium dichromate and sodium thiosulphate.^[1]

III. RESULTS AND DISCUSSION

The water samples were analyzed for physicochemical characteristics. The physicochemical parameters were analyzed namely pH, EC, TS, TDS, Total Hardness, Chloride, PO_4 and SO_4 (Table 1).

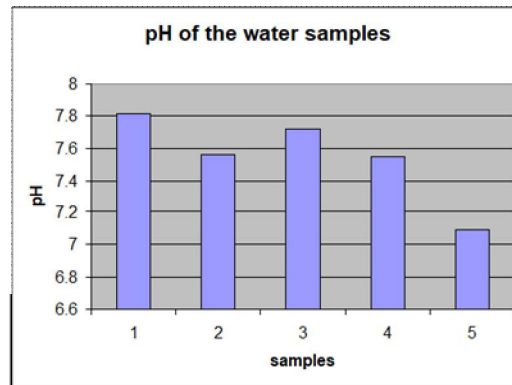
1.2. Temperature:

Temperature of water may not be as important in pure water because of the wide range of temperature tolerance in aquatic life, but in polluted water, temperature can have profound effects on dissolved oxygen (DO) and biological oxygen demand (BOD). The fluctuation in river water temperature usually depends on the season, geographic location, sampling time and temperature of effluents entering the stream. The water temperature was found to be maximum 27.5°C East. The temperature of west and north was recorded (Figure 1) as 26°C . The lowest water temperatures were observed in south site 25°C . The variation is mainly related with the temperature of atmospheric and weather condition.

Parameter	Standard Value as per WHO	Unit	S ₁	S ₂	S ₃	S ₄	S ₅
pH	7-8.5		7.81	7.56	7.72	7.55	7.09
Turbidity	2.5	NT	3	2	3	2	2
Electrical Conductivity	300	$\mu\text{S}/\text{Cm}$	1155	1538	908	1569	1950
Total Dissolved Solids(TDS)	500	mg/L	785	1046	617	1067	1326
Total Hardness as CaCO_3	100	ppm	300	464	208	424	464
Ca^{2+}	75	mg/L	54	99	43	90	94
Mg^{2+}	30	mg/L	39	52	24	48	55
Na^{+}	200	mg/L	98	100	86	120	188
K^{+}	200	mg/L	18	22	26	22	42
Alkalinity total as CaCO_3	200		328	384	240	340	344
Chloride as Cl^{-}	250	mg/L	164	204	140	232	262
Fluoride as F^{-}	1	mg/L	1.2	1.4	0.8	1.0	1.4
Sulphate as SO_4^{2-}	250	mg/L	24	59	27	41	54
Nitrate as NO_3	45	mg/L	9	13	8	13	13
Nitrite as NO_2	0.50	mg/L	0.14	0.09	0.13	0.06	0.08
Iron as Fe^{2+}	0.30	mg/L	0.22	0.44	0.38	0.44	0.35
Phosphate as PO_4^{2-}			0.06	0.10	0.10	0.08	0.06

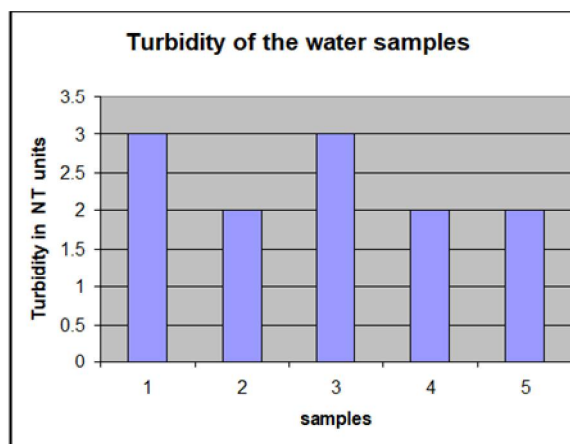
1.1. pH

The value of pH was found in the range 7.09 to 7.81 showing that water is alkaline in all stations. It shows that the pH value of all samples falls within the permissible limit of World Health Organization.



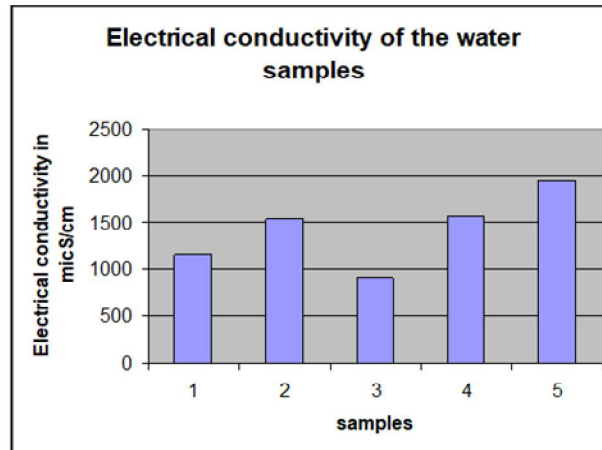
1.3. TURBIDITY:

Turbidity is an important parameter of water quality analysis. It is caused by the presence of a lot of dust, organic-inorganic matter, soluble colored organic compounds and other microscopic substances. The turbidity of water samples in the range from 2 to 3 NTU. It shows that it is in higher value than the permissible limit except S2 and S4, S5. The turbidity is also due to the presence of excess amount of manganese, iron, calcium carbonate and other limestone complexes. It is also observed that in S1 the presence of iron is observed as 0.22ppm, S3 has 0.38ppm.



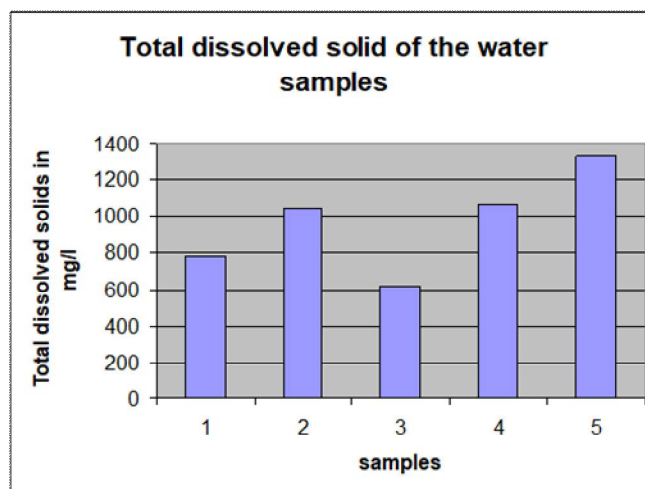
3.4 ELECTRICAL CONDUCTIVITY:

The electrical conductivity of all five tested samples was found to be higher than the permissible limit. The values ranged from 908 to 1950 $\mu\text{S}/\text{cm}$. The high values of EC were due to high concentration of ionic constituents present in the water bodies. The sample with high EC is not generally suitable for irrigational purpose. ^[12]



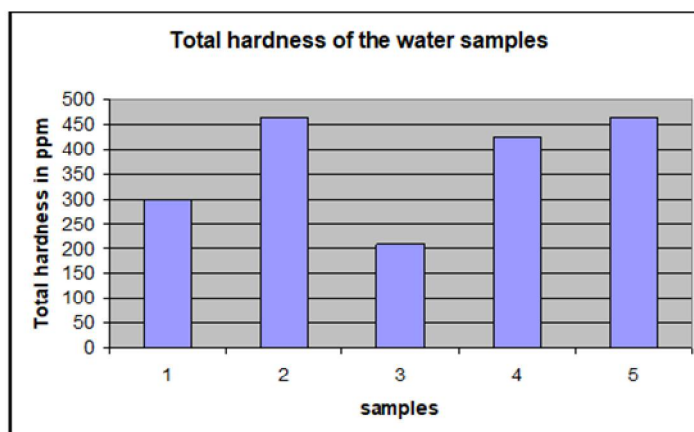
3.5 TOTAL DISSOLVED SOLIDS [TDS]:

Present investigation showed that all the samples have crossed the permissible limit of 500mg/L. Their values ranged from 617 to 1326mg/L respectively. This is due to the contamination of variety of soluble salts.



3.6 TOTAL HARDNESS AS CaCO₃:

Hardness in the tested samples were found to be in the range 208 to 464ppm. This shows that it is in higher value than the permissible limit of 100ppm. This is due to the natural accumulation of calcium and magnesium along with their carbonates, sulphates and chlorides and the higher value is mainly found to abundant availability of limestone rocks in the surrounding area. There is a possibility of causing stones in kidney, liver and urinary tracks due to hardness.



3.7 CALCIUM:

The amount of calcium is observed high in S2, S4 and S5 than the permissible limit of 75mg/L. Their corresponding values are 99, 90, 94 mg/L respectively. This is due to over deposit of limestone, dolomite present in the surrounding area. The minimum values have also been recorded as 54 and 43mg/L for S1 and S3. Excessive amount of calcium results in calcification of tissue, cataracts, kidney stones and gallstones.

3.8 MAGNESIUM:

Magnesium is a beneficial metal, but it is toxic at high concentration. The magnesium ion concentration of all the five samples was within the range 24 to 55mg/L. Concentration of magnesium was more than its permissible limit except S3. The high concentration is because of the presence of magnesium rock in the surrounding area. It produces hardness to water so water becomes very hard.

3.9 SODIUM

It is observed that the concentration of sodium for all the samples have found below the permissible. The minimum and maximum recorded values of sodium was 86 and 188mg/L. It may produce salinity to water.

3.10 POTASSIUM

Potassium has similar properties to sodium. In all the samples the maximum and minimum values were 22 to 42mg/L. So it is found below the permissible limit.

3.11 ALKALINITY AS CaCO_3

Alkalinity ranges from 240 mg/L to 384 mg/L in the study area. It is observed that its concentration is above the permissible limit of 200. The total alkalinity recorded was due to accumulation of carbonate, bicarbonate and hydroxide etc. ^[14]

3.12 CHLORIDE

Chloride is one of the major inorganic anions of water. High concentration of chloride is due to leaching of organic wastes of animal origin and discharge of effluents from industries. Concentration of chloride was ranged from 140 to 262mg/L which was found to be low than the permissible limit except S5. Chlorine is also added as germicide as bleaching powder in municipal water and other water treatment.

3.13 FLUORIDE:

In the tested five samples of water, the fluoride concentration was found to be high than the permissible limit except S3 and S4. Fluoride is essential in small quantities for the prevention of dental caries especially in children. Therefore it is a common practice to add very low concentration of fluoride to toothpaste and drinking water (less than 1ppm) at places where there is natural deficiency of fluoride ^[13]. Excess amount of fluoride intake of 2 to 80ppm for about 10years may cause dental as well as skeletal fluorosis.

3.14 SULPHATE:

Sulphate is most of the samples were found to be lower than the desirable level, that is 250mg/L. The maximum and minimum values for all the five samples were recorded as 24, 59, 27, 41 & 54 mg/L respectively. Sulphate will react with Ca^{2+} or Mg^{2+} to form CaSO_4 or MgSO_4 and produce hardness to water.

3.15NITRATE [NO₃]:

The water samples are analysed and showed that the nitrate concentration range of 9 to 13mg/L and it was found to be within the permissible limit of 45mg/L. The nitrates get concentrated in the water when their concentration exceeds 25mg/L, they become the cause of a serious health hazards called "Blue Baby Syndrome" or methaemoglobinemia. This disease affects the infants to the maximum extent causing even death.

3.16NITRITE [NO₂]:

The concentration of nitrite was found within the permissible limit for all the samples and their corresponding values are 0.14,0.09,0.13,0.06,0.08mg/L.

3.17PHOSPHATE [PO₄]:

In the tested water samples the concentration of phosphate was found to be 0.06 to 0.10smg/L. A large proportion of nitrogen and phosphorus used in the crop fields is washed off and along with water reach the water bodies causing over nourishment of the lakes, a process known as "Eutrophication" (eu=more,trophic=nutrition). Due to eutrophication the lakes get invaded by algal blooms. These algal species grow very fast by rapidly using up the nutrients. They are often toxic and badly affect the food chain.

3.18IRON

The concentration of iron is found to be higher than the permissible limit for S₂, S₃, S₄ and S₅. Their corresponding values are 0.44, 0.38, 0.44 and 0.35mg/L. Iron is a vital element in human nutrients. Anemia and impaired oxygen delivered is due to iron deficiency. Iron causes siderosis, heptamia and cancer, diarrhea, hypothermia. It may affect gastrointestinal track, liver, kidney, heart, brain, spleen and adrenal etc.

IV. SUMMARY

- The analysis of well water samples shows that they are not really suitable for drinking purpose. All the site owners must use reverse osmosis process to make it for drinking purpose.
- The site owners of the well water had been affected by thyroid disease due to high Fluoride ion concentration.
- But it was quite unbelievable that stored rain water of my research area having very high hardness and electrical conductivity values. So according to me the soil of my research area must be rich in calcium strength. But it may be possible in the form of dolomite rocks on that area.
- The availability of Nitrogen, Phosphorous & Potassium are high in all the soil samples. This may due to the usage of urea, fertilizers in day to day agriculture system.
- The presence of micronutrients such as Iron, Manganese, Zinc and Copper lies within the permissible range. All the micronutrients are considered as heavy metal elements in the field of chemistry. So it can be concluded a good soil must have a critical limit of heavy metals on it.
- But the presence of Iron within the critical limit indicates that all the samples are non-calcareous solids (i.e.) low CaCO₃ concentration.
- Since mainly well waters are used for the irrigation of soil samples S₂, S₃, S₄, S₅. All the well water has alkaline range. The soil sample S₁ is mainly based on rain water for the irrigation with neutral P^H.
- So, I could clearly say that from all the above facts these soil samples are able to produce good crops in a very great quality.

REFERENCES

- [1] APHA, Standard methods for analysis of water and wastewater. 18th edition. American public health Association, Washington D.C 1992.
- [2] Meybeck M, Rev. Geol. Dyn. Geogr. physics 1997, 21, 215-246.
- [3] Manivasakam N, physical chemical examination of water, sewage and industrial effluents 3rd edition, Pragati Prakashan, Meeret, India 1996.
- [4] Nagarajan S, Swaminathan M and Sabarathinam PL, Poll. Res., 1993 12(4), 245-250.
- [5] Patel M.K, Mohanty K, Tiwary T.N and Patel T.K, Indian journal environment prot, 1994, 14(5), 373-379.
- [6] Mittal S.K and Verma .N, Indian journal environment prot, 1970, 17(6) 426-429.
- [7] Nawlakhe, W.G Lutade S.L, Patni P.M and Deshpande L.S., Indian journal environment prot 1995 37(4), 278-284.
- [8] Shastri S.C, Bakra P.P and Khan J.I, Industry Environment and the law, 1996 R 13SA Publishers, Jaipu.
- [9] Chandrawat M.P, Ojha T.N, Yadav R.N, Hydrofluoroid problems in and around Ramagarh Town. Zafar A.R, on the ecology of algae in certain ponds of Hyderabad, India, physicochem complex Hydrobiologia 1964, 23, 179.
- [10] Chaturvedi S, Kumar D, Singh R.V. astudy on some physicochemical characteristics of flowing water of Ganga river at Haridwar. Res Journal chemistry environment 2003, 7, 78.

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

Volume 7, Special Issue 8, September 2018

International Conference on Emerging Trends in Science, Technology and Mathematics (ICETSTM-2018)"

22nd August 2018

Organized by

Department of Computer Science, Parvathy's Arts and Science College, Dindigul, Tamilnadu, India

- [11] Regina .B, Nabi.B, Physico chemical spectrum of the Bhavani river water collected from the Kalingarayan Dam .Tamilnadu Indian Journal Environ Ecoplan 2003.7,633.
- [12] Abbasi, S.A and S. Vinithan,1999. Water quality in and around and an industrialized suburb of Pondicharry, Indian Journal Environment Prot.,41,253-263.
- [13] Harish Babu.R, E.T. Puttaiah and Vijayakumara.2006. Status of drinking water quality in Tarikere taluk with special reference to fluoride concentration. Nature Environment pollution technology 5(1), 71-78.
- [14] Jameel.A.A and A.Z. Hussain, 2007. Assessment of ground water quality on banks of Uyyakondan chsnnel of river Cauvery at Tirchirapalli, Indian journal Environment Prot., 27,713-716.