World Journal of Engineering Research and Technology
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PHYSICO-CHEMICAL ANALYSIS OF THE GROUND WATER IN DINDIGUL DISTRICT TAMILNADU INDIA

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Article Received on 12/10/2019 Article Revised on 02/11/2019 Article Accepted on 23/11/2019

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ABSTRACT

Water, the elixir of life, is a key natural resource, a basic human need and a valuable asset to the country. Water quality parameter analysis is essential and this information is highly helpful to aware about the rate of contamination. This paper aims to assess the quality of groundwater and compares with standard guideline values recommended by the Bureau of Indian Standards (BIS) for suitability. The water samples were collected from the various areas in the Dindigul district and analysed for the quality parameter viz., hardness alkalinity, and metal content physical properties. The obtained values are compared with the standard values and the results show that the values obtained are in accordance with standard values and it is suitable for the agricultural and domestic purpose.

KEYWORDS: Physico-chemical, Ground water, Dindigul, Water quality.

INTRODUCTION

Water is nature's most wonderful abundant and useful compound of the many essential elements for the existence of human beings. Its importance extends to animal and plants too. Thus water is required for the satisfactory performance of various life processes, circulatory fluid, as a carrier of nourishing food, for the removal of products of wastes etc. Rain water is probably the purest form of natural water since it is obtained as a result of evaporation from

the surface water. However during the journey downwards through the atmosphere it is dissolved a considerable amount of industrial gases like CO_2, SO_2, NO_2 etc. and suspended solid particles both of organic and inorganic origin. The river water contains greater amount of dissolved impurities due to the minerals of the soils such as chlorides, sulphate, and bicarbonates of sodium, calcium, magnesium and iron. Lake water contains much lesser amounts of dissolved minerals but quantity of organic matter present in it is quite high. The ground water table increases through the charging of aquifers during rainfalls. The quality of ground water depends on the soil which contains minerals through which the water percolates into the aquifers.[1] Global climatic changes alter the rainfall pattern which contributes to the water crisis and over exploitation of groundwater results in declining the water level as well as quality of water.[2] The excessive use of fertilizers in the agricultural field and consequence contamination of water bodies through eutrophication led to the contamination of underground water.[3] Many cities and villages in India dependent on groundwater for drinking and other purpose.[4,5] Due to over population, urbanization, and dumping of the wastes and effluents at inappropriate place enhance, the infiltration of harmful compounds to the groundwater may cause changes in water quality parameters.[6] In this paper the underground water samples collected from the Dindigul district of Tamil Nadu have analysed for water quality parameters and compared with the standards prescribed by Bureau of Indian Standards (BIS).

MATERIALS AND METHODS

The water samples (WS) subjected for the physico-chemical analysis were collected is given in Table 1. The collected water samples transferred to the laboratory and analysed for the water quality parameters as per the standard procedures. pH, Colour, Turbidity and TDS of the water samples have been determined using pH meter, Visible Spectrophotometer, Nephelometer and Gravimetric method respectively. Alkalinity of the water samples have been determined using the indicator method and metallic ions have been analysed using Flame photometer. Anions present in water samples have been found and determined using Ion Selective Electrodes. Kjeldahl Analyzer is used to determine the nitrogen content present in the water samples.

Table 1: Details of The Collected Water Samples.

Area	WS 1	WS 2	WS 3
District	Dindigul	Dindigul	Dindigul
Taluk	Palani	Palani	Palani
Village	Kanakkanpatti	Shanmuganathi	Kombaipatti
Source of water	Well water	River water	Bore well water

RESULTS AND DISCUSSION

The Physico-chemical analysis of ground water samples have been determined and the physical parameters have been shown in Table. 2.

Table 2: Physical Parameters of Water Samples.

S.No.	Parameter	WS 1	WS 2	WS 3
1	pH	7.73	7.82	7.74
2	Turbidity NT units	2	1	2
3	TDS (in mg/L)	411	170	487
4	Conductivity (mS/cm)	604	249	716

pH represents the hydrogen ion concentration in water. The pH of neutral water is 7. A pH value of less than 7 indicates acidity and a value above 7 indicates alkaline nature of water. When CO_2 is absorbed carbonic acid is produced and pH of water is decreased. A pH of 4.0 or less indicates mineral acidity contributed by mineral acids like hydrochloric acid and sulphuric acid. The pH of the water samples subjected for analysis having a pH range between 7.7 – 7.8. This indicates that the water samples are slightly alkaline in nature.[7] Turbidity in water is caused by suspended matter such as clay, salt, finely divided organic and inorganic matter, soluble coloured organic compounds and plankton and other microscopic organisms. The turbidity test can act as a watch dogs for such treatment plants and the plant engineer can have a good control over plant efficiency and performance. Leakage in pipe lines is indicated by an increase in turbidity. Corrosion in pipes is another cause for increase in turbidity in transmission mains. Presence of iron bacteria may be a cause for turbidity in tap water and public fountains. The samples collected from Palani and its surrounding areas are having Turbidity range between 1 and 2. This indicates that the water samples are ideal for domestic and industrial usage. Total dissolved solids (TDS) give the amount of soluble inorganic and organic substances present in water. A saline water will have high TDS.[8] A ground water will high TDS compared to a surface water. For most of the natural water the main contributors for TDS are salts of calcium, magnesium, sodium and potassium etc. A low TDS water denotes that these parameters are within safe limits. The TDS of the collected water samples WS1, WS2 and WS3 are 411, 170 and 476 respectively.

Electrical conductivity indicates the level of total dissolved solids in water. The permissible level for total dissolving solids is 500 mg/L. The analysed water samples having conductivity lies between 249 and 716 mS/cm.

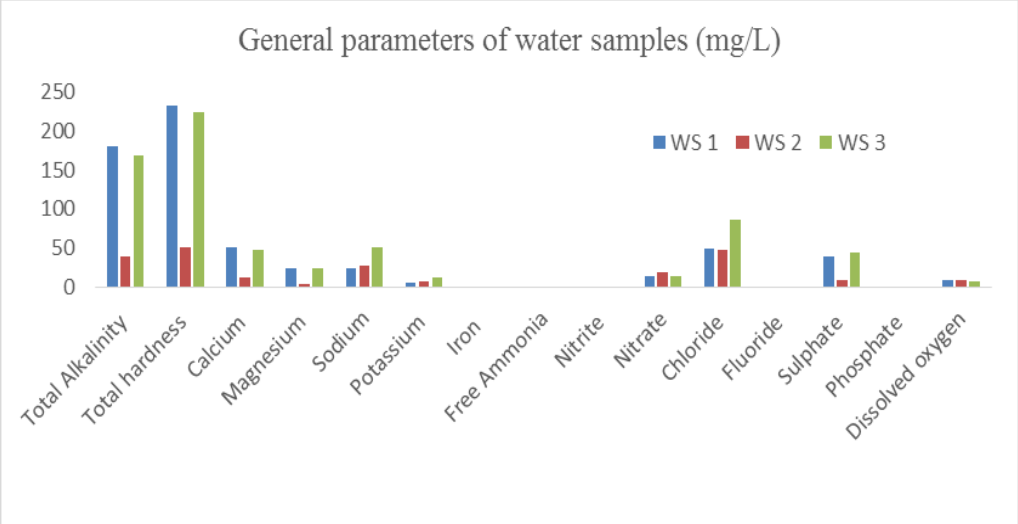
The general parameters of the water samples have shown in Table 3.

Table 3: General Parameters of Water Samples (mg/L).

S.No.	Parameter	WS 1	WS 2	WS 3
1	Total Alkalinity	180	40	168
2	Total hardness	232	52	224
3	Calcium	51	13	48
4	Magnesium	25	5	25
5	Sodium	24	28	52
6	Potassium	6	7	13
7	Iron	0.22	0.29	0.57
8	Free Ammonia	0.33	0.60	0.32
9	Nitrite	0.18	0.19	0.25
10	Nitrate	15	19	14
11	Chloride	50	48	86
12	Fluoride	0.4	0.4	0.6
13	Sulphate	39	9	44
14	Phosphate	0.45	0.31	0.30
15	Dissolved oxygen	9	10	7

The water used for domestic as well as industrial purposes should have moderate alkalinity. The underground water samples WS1 and WS3 having alkalinity of 180 and 168 mg/L respectively whereas river water sample WS2 contains 40 mg/L. A natural cause of alkalinity may be lime deposits at the source of water. Acidic and alkaline wastes from industries can also change the alkalinity of water. Total Hardness is due to the presence of calcium and magnesium ions. When the hardness value is greater than alkalinity value, the alkalinity is equal to carbonate hardness and the amount of hardness in excess of this is called non carbonate hardness.[9] When hardness is equal to or less than the alkalinity value, the entire hardness is only carbonate hardness and there is no non carbonate hardness. The water samples having the total hardness as $CaCO_3$ ranging from 52 to 232. From the analysis it is revealed that the river water sample WS2 contains lesser hardness than the ground water samples. Iron may be present in ferrous form or Ferric form. If it is present in Ferric form the water will have turbidity. If the water under study is a ground water, the turbidity may be only due to iron. For a surface water the turbidity may be high even if it does not contain high amount of iron. Iron may be associate with traces of manganese as both have more or less similar properties. Iron can be removed by aeration and filtration. The water samples

collected having the total iron ranging from 0.22 to 0.57 mg/L. When there is a pollution, particularly sewage pollution, the water may contain Ammonia. The samples collected from Palani and its surrounding areas having the free ammonia, ranging from 0.32 to 0.60. Nitrate is also an indicator of pollution. Due to application of large amounts fertilizers the nitrate content in ground water is increasing all over the world. However high nitrates have accorded in some places where there is no agricultural activity. This may be due to nature of soil. The removal of nitrate from water is not an easy process. The samples collected from Palani and its surrounding areas having the Nitrate ranging from 14 to 19 mg/L. The determination of chloride content in water samples give an idea about the contamination of water samples by waste water, soluble chloride salts etc.[10] The acceptable level prescribed by BIS is 250 mg/L, whereas the amount of chloride present in the groundwater samples is between 48mg/L and 86 mg/l. The chloride content in all the water samples lies well below the acceptable limit. The chloride content of the water samples revealed that the water samples were free from any water pollution. Fluoride may occur naturally in water and therefore a detailed water quality survey can indicate the regions contaminated with fluoride. As per BIS norms fluoride is a health significant parameter and a level of more than 1.5 mg/L should not be permitted. It should be noted that the level of electrical conductivity of water does not reflect the level of fluoride. The water samples collected having the Fluoride ranging from 0.4 to 0.6 mg/l. Phosphate is usually present in trace levels in water. However presence of phosphate pollution can raise the level of phosphate in water. If the level of ammonia and phosphate are high it definitely indicates sewage pollution. The samples collected from Palani and its surrounding areas having the Phosphate as PO_4 ranging from 0.30to 0.45 mg/l. The dissolved oxygen content of the water samples are found to be 9, 10, 7 mg/L respectively.



CONCLUSION

The pH of the water samples revealed that the samples are slightly alkaline in nature. The total dissolved solids of the collected water samples lies below the acceptable limit prescribed by BIS. The total alkalinity of the water samples in accordance with the BIS standards. The ground water samples have slightly high total hardness than the standard prescribed by BIS but well below the permissible limit. The presence of various anions in the collected water samples are in good agreement with the standards of BIS. The physico-chemical analysis of the collected water samples revealed that the water sources in the collected area are ideal for various uses.

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