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Analysis of sub surface water of Khapri village of Nagpur district

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ABSTRACT

In this project, the physicochemical analysis of various physicochemical parameters is carried out for the assessment of groundwater quality. Total of 12 samples was collected from 12 locations of Khapri Village in Kalmeshwar Taluka in Nagpur District of Maharashtra State, India. It comes under Khapri Panchayath. It belongs to the Vidarbh region. These 12 water samples were collected from sampling points whose connection was given to bore wells. Various physicochemical parameters tested were pH, alkalinity, sulfate, nitrate, total hardness, dissolved oxygen, lead content, total solids, total dissolved solids, suspended solids, electrical conductivity, and turbidity. For geo-referencing of study area of Khapari Kothe Village latitude 21°14'35"N and longitude 78°51'14"E was used. The observed values of these physicochemical parameters were compared with World Health Organization standards. The results indicated that the water quality of groundwater is assessed in the study area based on the water quality index model. The drinking water quality results of the Khapri Village, show that the highest water quality was recorded at the Sample no 5 (WQI = 80.218) due to the increases in the human population, agricultural activities and it was very close to septic system, whereas the lowest quality found at Sample no 2 (WQI = 19.075). These water samples were fit for drinking without proper treatment according to standard World Health Organization.

Keywords— *BIS, Water Quality Index, Physical-chemical parameters, Groundwater*

1. INTRODUCTION

Water is one of the most important, universal and most precious natural resources. It is essential in the life of all living organisms from the simplest plant and microorganisms to the most complex living system such as of human body. Water is a combination of hydrogen and oxygen atoms, with a chemical formula, H_2O and it is known to be the most abundant compound (70%) on earth's surface. It is significant due to its unique chemical and physical properties. Ground water is the major source in India not only for domestic use but also for agriculture and industrial sector. At present scenario, 85% of domestic water requirement in rural areas, 55% of irrigation water requirement of farmers, 50% of domestic water requirement in urban areas and 50% of process water requirement of industries are met by ground water. Ground water is ultimate, most suitable fresh water resource with a nearly balanced concentration of the salts for human consumption.

Acceptable ground water quality shows that the ground water should be safe in terms of its physical, chemical and bacteriological parameters. International and local agencies have established parameters to determine the biological and physicochemical quality of ground water. It has been estimated that the most common problems in household water supplies are mainly to hardness, fluorides, sulphides, sodium chloride, alkalinity, acidity, disease-producing pathogens such as bacteria and viruses, etc. Thus, if the physico-chemical constituents of ground water used for drinking exceed its maximum permissible limits it causes adverse health effects on mankind.

Water plays an important role in all living organism. The chemical formula of water is H_2O. It exists in the three states namely solid, liquid and gas. Water is a universal solvent used as media for bio-chemical as well as a chemical reaction. Water is essential for all living organism. Life cannot run without water. On earth 97.2% of water is salty and 2.8% is fresh water from which about 20% constitutes ground water (Rajesh Kumar, 2011). The rapid growth of industrialization, population urbanization spoils the ground water. Once ground water gets polluted, it cannot be restored by stopping the pollutants from their source.

According to WHO, about 80% of diseases in a human being are caused by water (Neerja Kalra, 2012). Also, ground water is used by the people throughout the world for various domestic purposes such as drinking, cooking, bathing, etc. So the study of ground water becomes very important lest the people are using ground water which is unsafe. In India, 90% of the rural and nearly 30% of the urban populations depend on groundwater for meeting their drinking and domestic requirements. Therefore, it is desirable to

control the intake of these potentially toxic chemicals from drinking water. Hence, the aim of this study is also to examine the levels of some physicochemical parameters of drinking water of a few Urban Areas of Bangalore. In recent decades, water pollution has reached such magnitudes that it not only threatens the health and well-being of people but also has potential adverse impacts at a regional and global scale. Water resources are found to be the most exploited resource. According to the United Nations report, fresh water availability is becoming a matter of concern, with nearly 900 million people affected by water borne diseases. In the fresh water available on earth, groundwater is an important source for most of the world"s population. Productivity in terms of both agriculture and industries through groundwater is quite high when compared to surface water, but groundwater sources have not yet been properly developed through exploration. Water resource assessment of a region involves a comprehensive study of both the surface and subsurface water quality. Urbanization and population burst have induced much pressure on the availability of natural resources. It is well known that the common effect of most of the urbanization is that it creates an impermeable proportion of land surface and also contaminates groundwater.

With technological advancement and with the increasing industrial activities, the natural environment suffers from the detrimental effects of pollution. The growth of human population and rapid industrialization has led to increasing effluents which has led inevitably, to alteration in the quality and ecology of receiving water bodies. This brings new challenges to both water resource managers and aquatic ecologists today, most urban areas of the developing world remain inadequately served by sewage treatment infrastructure. Untreated wastes pose a serious threat to the associated environment including human health. The extent of pollution depends on uncontrollable climatic conditions and topographical and geological features of the area. As a result, the extent may vary from place to place and time to time.

2. OBJECTIVES OF THE PROPOSED WORK

To Analyse the ground water quality of Khapri Village by determining the physicochemical parameters as shown below:
(a) pH using a pH meter
(b) Alkalinity using phenolphthalein indicator (By Titrimetric Method)
(c) Turbidity by using Nephelometer
(d) Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and Total Solids (TS) (By Gravimetric Method)
(e) Electrical Conductivity (EC) using Conductivity Meter
(f) Total hardness of water (By EDTA Titrimetric Method)
(g) Sulphate content (By Titrimetric Method)
(h) Nitrate Content (By Spectrophotometer)
(i) Dissolved oxygen content (By Azide Modification / Winkler's Method)
(j) Lead content of various water samples

One of the main objectives of the ground water quality monitoring is to assess the suitability of ground water for drinking purposes. The physical and chemical quality of ground water is important in deciding its suitability for Drinking Purposes

3. LITERATURE REVIEW

Mohsin and Sahib (2013) in comparison the groundwater quality with WHO popular and associated it to illnesses in town. A laboratory test was used to take a look at the first-rate of samples, and questionnaires were used to test the quantity of groundwater. It was concluded that the groundwater is infected; for this reason, the filtration plant ought to be set up in three locations (or) regions. Water is the maximum crucial liquid for maintaining life on this planet. Already fresh water has emerged as a depleted aid in many elements of worldwide, and unluckily in developing international locations the ingesting water is constantly contaminated and dangerous for human uses.

Ali Bawasheakh Ahmad et al. (2014) this examine became conducted over seven villages near Darbandikhan district along with (2) wells and (five) springs. It covers extra than 60 km2, to assess the suitability of floor water fine for ingesting reason using water first-rate index through investigating of various wells and springs; this technique may be a very beneficial tool for short assessment for any water machine. This becomes done by way of subjecting the seven water resources inside the cited region beneath investigation, wherein consuming water samples aren't dealt with earlier than consumption. For calculating Water Quality Index, fourteen parameters together with (pH, TDS, EC, Turbidity, Total Hardness as $CaCO_3$, Calcium, Magnesium, Sulphate, Chloride, Nitrate (NO_3-N), Nitrite (NO_2-N), Phosphate (PO_4-P), Sodium and Potassium) had been considered. The take a look at a spread over two seasons particularly fall and spring. The found values of these physicochemical parameters were compared with World Health Organization requirements. The results indicated that water satisfactory of springs and wells varied from incredible water best (A) to true water first-rate (B).

Oyem et al. (2015) analysed the awareness of selected heavy metals inside the groundwater. The iron content of person sample in sub-areas has been in comparison exceptionally to WHO standards. The correlation between selected heavy metals within the groundwater become provided. The end result of this analysis did now not monitor any strong or good sized inter-metallic dating within the groundwater. Report well-known shows that the groundwater aquifers of Agbor and Owa region usually meet the national and international requirements.

Shanmugasundharam et al. (2015) used Wilcox diagram to envision the groundwater suitability for irrigation reason. In urban regions, the groundwater is the source of drinking water supply and the accelerated pollutants level has reduced the portability of water.

Salifu et al. (2015) aimed at the assessment of groundwater for irrigation motive and percentage sodium content was an indicator of sodium chance. Permeability of the soil was reduced because the sodium content material of the water reacts with the soil. The shape of the soil became also destructed and the bodily houses get altered. Alkali soils are shaped while sodium reacts with carbonate

and saline soil become formed while sodium reacts with chloride, each of the soil do no longer favour the increase of plant. HCO^{3-} combines with Ca^{2+} and Mg^{2+} and the concentration receives multiplied. High SAR in irrigation water modifies the physical systems of the soil. Soil debris is attracted closer to sodium and adsorbed on the surface, making soil impervious. High EC content within the irrigation water reduces the ion intake capability of plant roots from the soil, which ends up in discount of crop yield. Even if the moisture content material of the soil is excessive, the plant would not be capable of taking in the moisture and nutrients required for growth. Salinity circumstance exists as salt receives accumulated in the root quarter of the vegetation if the groundwater with excessive TDS is irrigated continuously. In saline solution, vegetation is not able to extract water and ultimately yield receives reduced. Ion alternate among the water nice parameters is denoted through CAI. Positive CAI suggests there may be no alternate of the ion between Na^{+} K^{+} and Ca^{2+} $Mg^{2+.}$

Jeyaraj et al. (2016) determined that the efficient load on the Noyyal River has extended due to the discharge of commercial effluent and untreated sewage. Investigation exhibits that the water high-quality of Noyyal River has been degraded for this reason it's far unfit for human intake. The major supply of recharge for groundwater in Coimbatore vicinity is Noyyal River and its associated tanks. As the water quality in Noyyal River is degrading yr by way of yr it'll have an impact on groundwater exceptional.

Ali Bawasheakh Ahmad et al. (2016) this have a look at became performed over seven villages close to Darbandikhan district together with (2) wells and (5) springs. It covers greater than 60 km2, to assess the suitability of floor water best for ingesting reason using water high-quality index via investigating of different wells and springs; this approach is a very useful tool for quick assessment for any water device. This becomes performed by means of subjecting the seven water resources inside the mentioned place beneath investigation, in which drinking water samples aren't handled before intake. For calculating Water Quality Index, fourteen parameters including (pH, TDS, EC, Turbidity, Total Hardness as $CaCO_3$, Calcium, Magnesium, Sulphate, Chloride, Nitrate (NO_3-N), Nitrite (NO_2-N), Phosphate (PO_4-P), Sodium and Potassium) had been considered. The examine spread over two seasons particularly fall and spring. The determined values of these physicochemical parameters had been in comparison with World Health Organization standards. The consequences indicated that water fine of springs and wells varied from great water best (A) to good water quality (B).

4. METHODOLOGY OF PROPOSED WORK

4.1 Selection of study area

In this phase, under the guidance of our guide, we selected the study area i.e., the area is taken into consideration for the physicochemical analysis of groundwater quality Then we decided the twelve no of locations at Khapri Village in Kalmeshwar in Nagpur District of Maharashtra State, India. It belongs to Vidarbh region. It belongs to Nagpur Division. It is located 31 KM towards west from District headquarters Nagpur. 791 KM from State capital Mumbai. Khapri is surrounded by Saoner Taluka towards North, Katol Taluka towards west, Hingna Taluka towards South, and Nagpur Taluka towards East. The study area of Khapari Village latitude 21°14'35"N and longitude 78°51'14"E was used.

Fig. 1: Study area of Khapari village Kalmeshwar in Nagpur district

4.2 Sampling of groundwater from selected sampling points

Fig. 2: Sampling cans of 5 liters capacities

In this phase of the project, the sampling of groundwater was undertaken from the 12 selected sampling points located in the above mentioned 12 locations. This was done with the help of sampling cans of 5 litres as shown.

4.3 Physico-Chemical parameters

4.3.1 pH: pH stands for the "power of hydrogen". The pH value of water is defined as the log of the reciprocal of hydrogen ion concentration present in that water. The logarithmic scale of pH indicates that as pH increases, the H+ concentration will decrease by a power of 10 i.e., each number below 7 is 10 times more acidic than the previous number when counting down. Likewise, when counting up above 7, each number is 10 times more basic than the previous number. Thus, at a pH of 0, H+ has a concentration of 1 M. At a pH of 7, this decreases to 0.0000001 M. At a pH of 14, there is only 0.00000000000001 M H+.

4.3.2 Alkalinity: Alkalinity is the measure of the ability of water to neutralize acids. The major portion of alkalinity in natural waters is caused by carbonates, bicarbonates and hydroxides. It affects the boilers by forming scales on it.

4.3.3 Sulphate: The sulphate ion is one of the major anion occurring in natural water. Sulphate is one of the major dissolved components of rain

4.3.4 Nitrates: The nitrates can be present in excess quantity in the ground water if sewage percolates into the ground water due to improper management of sewage disposal

4.3.5 Total hardness: Hardness in water is that characteristic which prevents the formation of sufficient lather with soap. The hardness is usually caused by the presence of calcium and magnesium salts present in the water which form scum by reaction with soap. Thus, hard water contains dissolved magnesium and calcium ions which make it more difficult for the water to form lather with soap.

4.3.6 Dissolved oxygen: Dissolved Oxygen is the amount of gaseous oxygen (O_2) dissolved in the water. Oxygen enters the water by direct absorption from the atmosphere, by a rapid movement, or as a waste product of plant photosynthesis. Water temperature and the volume of moving water can affect dissolved oxygen levels. Oxygen dissolves easier in cooler water than warmer water. Adequate dissolved oxygen is important for good water quality and necessary to all forms of life.

4.3.7 Lead: Lead can enter drinking water when service pipes that contain lead corrode, especially where the water has high acidity or low mineral content that corrodes pipes.

4.3.8 Electrical conductivity: The electrical conductivity of water estimates the total amount of solids dissolved in water - TDS, which stands for Total Dissolved Solids. The electrical conductivity of the water depends on the water temperature: the higher the temperature, the higher the electrical conductivity would be. The electrical conductivity of water increases by 2-3% for an increase of 1 degree Celsius of water temperature

4.3.9 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 the air. The measurement of turbidity is a key test of water quality. Turbidity may be caused by particles suspended or dissolved in water that scatter light making the water appear cloudy or murky. Particulate matter can include sediment - especially clay and silt, fine organic and inorganic matter, soluble colored organic compounds, algae, and other microscopic organisms.

5. RESULT AND DISCUSSION

Quality of groundwater probably gets reduced to quite a low dilution. They are TDS, pH, TA, TH, NO_3, Cl, Fe and SO_4. The values of these parameters are found high above the permissible limits in some of the samples of the study area. The quality of sampled groundwater was compared with BIS (2009) standards. The desirable and permissible limits for drinking water as per Indian standard for drinking water ICMR and BIS 10500. The physicochemical analysis of various physicochemical parameters is carried out for assessment of ground water quality. Total of 12 samples was collected from 12 locations of Khapri Village.

Table 1: Value of groundwater quality parameters pH with pH meter, Alkalinity, SO_4 and pH with pH paper in the study area for 12 samples

Samples	pH with a pH meter	Alkalinity (mg/l)	Sulphate as SO_4 (mg/l)	pH with pH paper
1	7.25	84.00	75.41	6.50
2	8.08	272.00	45.89	8.00
3	7.52	328.00	83.00	7.50
4	7.10	176.00	179.05	7.00
5	6.96	244.00	161.62	6.50
6	7.34	220.00	67.47	6.50
7	7.06	320.00	68.06	7.00
8	8.20	190.00	71.14	7.50
9	7.68	184.00	109.44	8.00
10	6.85	128.00	24.30	7.50
11	6.66	186.00	115.61	6.50
12	6.92	96.00	35.21	7.00

Table 2: Value of groundwater quality parameters Lead, Total Solids and EC in the study area for 12 samples

Samples	Lead (mg/l)	Total Solids (mg/l)	Electrical Conductivity (mS/cm)
1	0.0034	2500	3.726
2	0.0019	2000	2.164
3	0.0037	2500	3.326
4	0.0049	2000	2.945
5	0.0081	2500	3.718
6	0.0038	2000	2.475
7	0.0044	2500	3.297
8	0.0039	2500	3.627
9	0.0057	1500	2.731
10	0.0040	2000	2.147
11	0.0039	1500	2.265
12	0.0021	2500	3.729

Table 3: Value of groundwater quality parameters NTU and TDS in the study area for 12 samples

Samples	Turbidity in NTU	Total Dissolved Solids (mg/l)
1	0.00	2500
2	0.00	1500
3	0.00	2000
4	0.00	2000
5	0.00	2500
6	0.00	1500
7	0.00	2000
8	0.00	2500
9	0.00	1500
10	0.00	1500
11	0.00	1500
12	0.00	2500

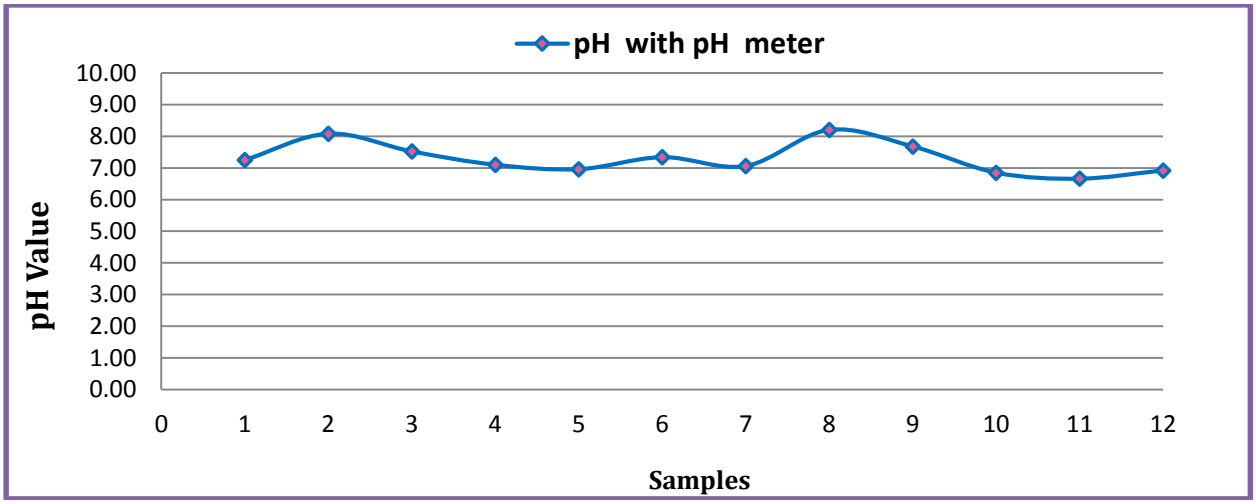

Fig. 3: Ground water quality parameters for pH with a pH meter

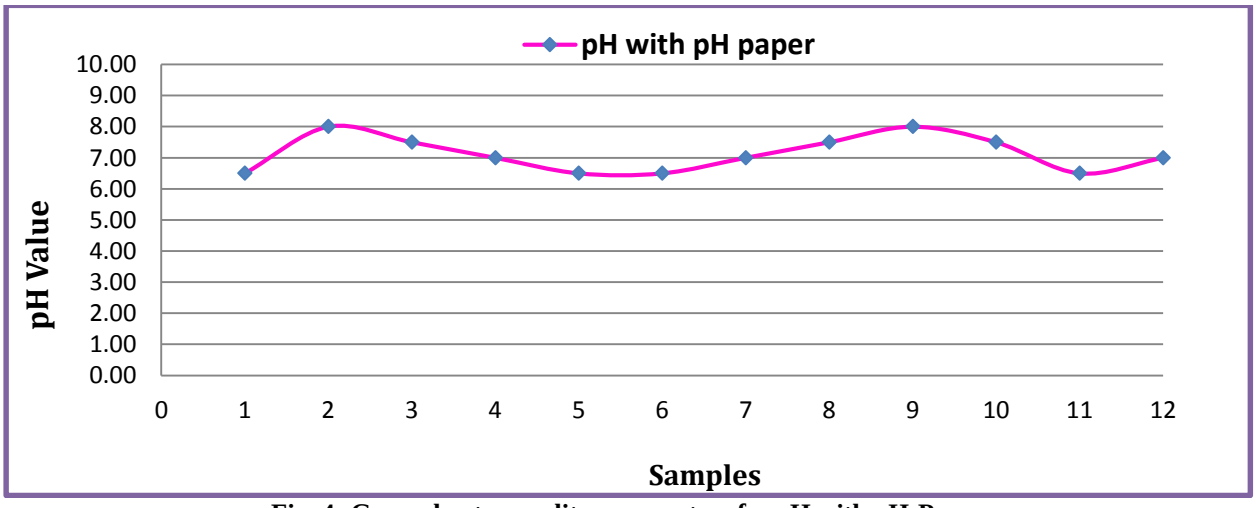

Fig. 4: Groundwater quality parameters for pH with pH Paper

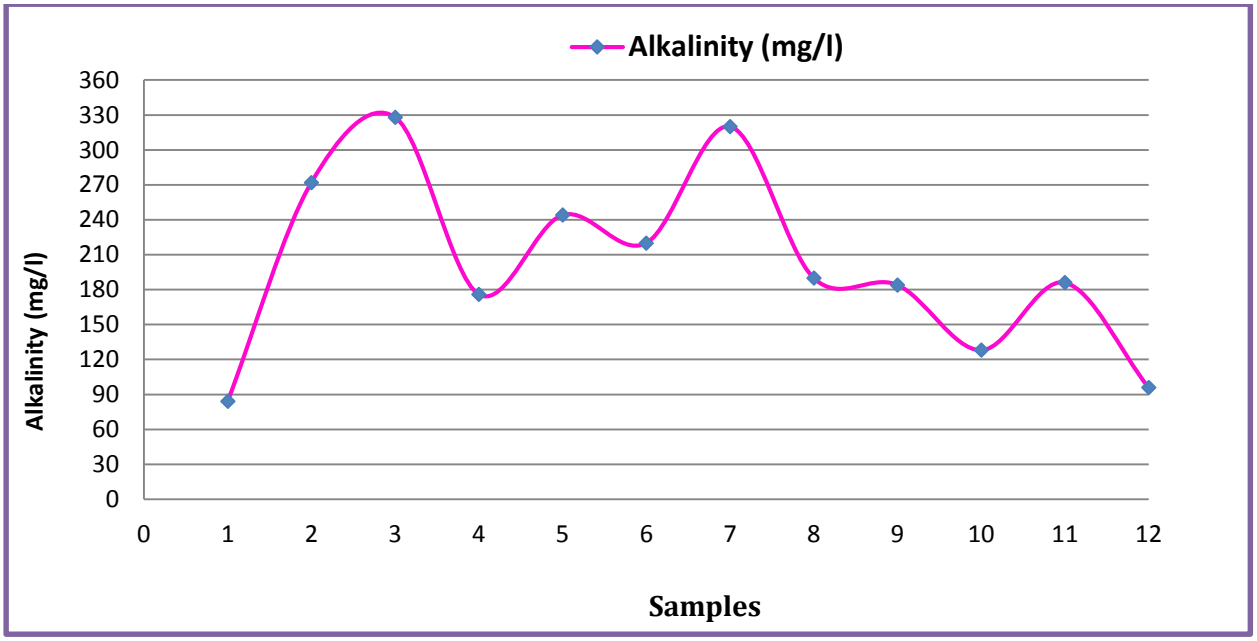

Fig. 5: Groundwater quality parameters for Alkalinity

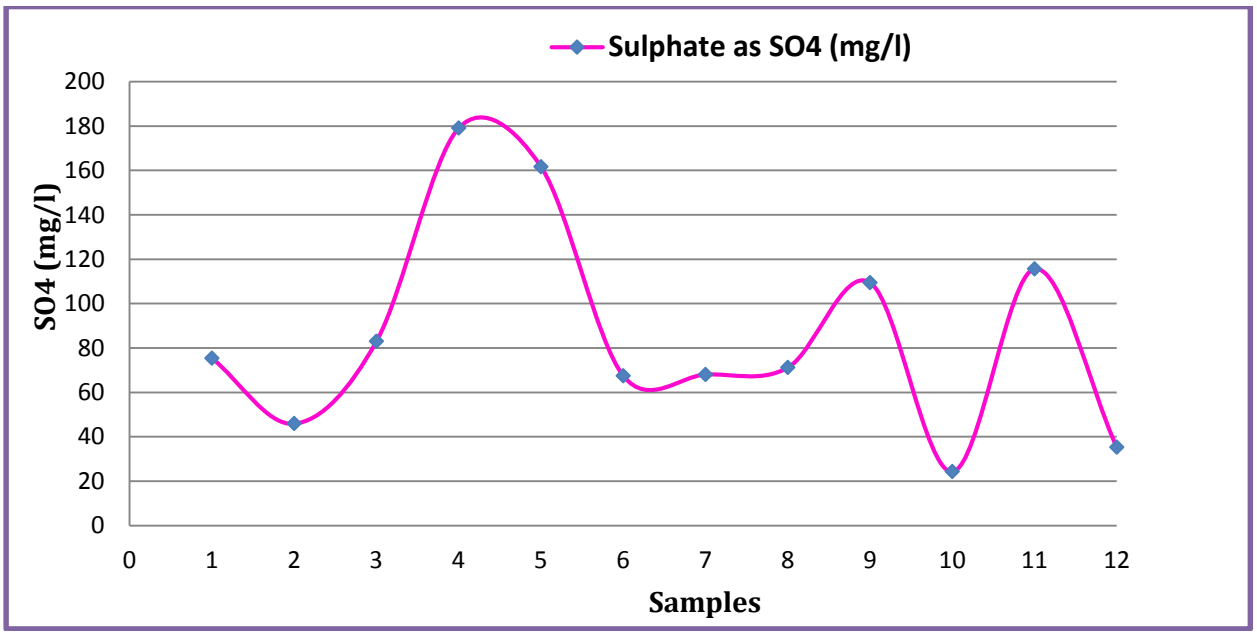

Fig. 6: Ground water quality parameters for Sulphate

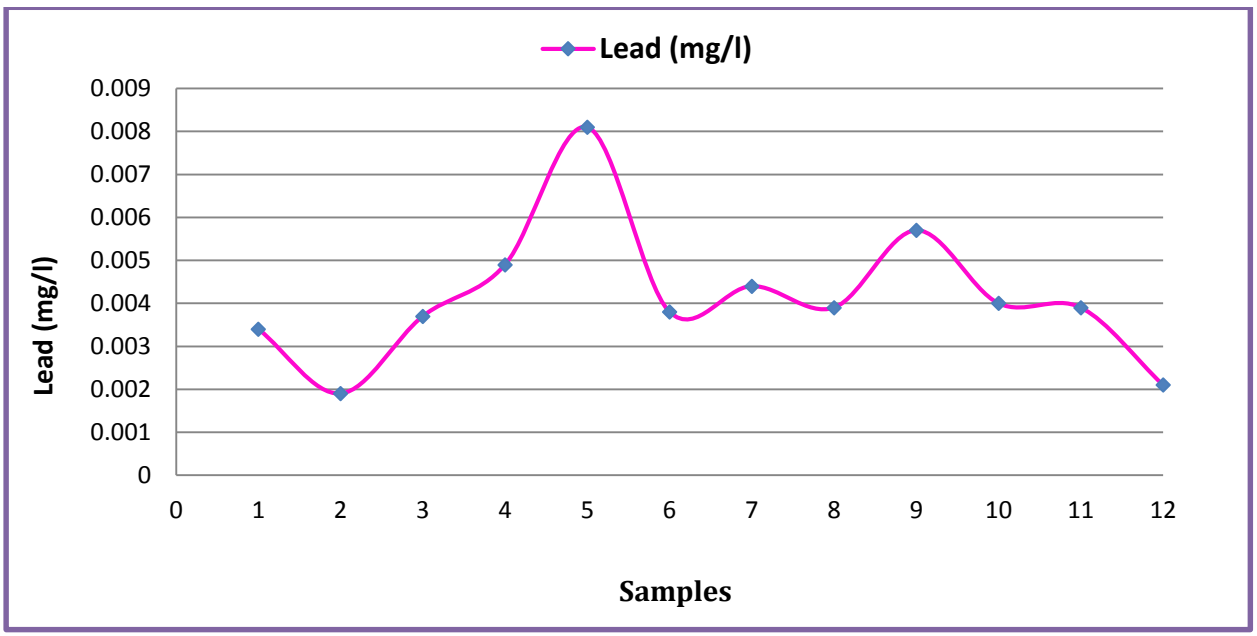

Fig. 7: Ground water quality parameters for Lead

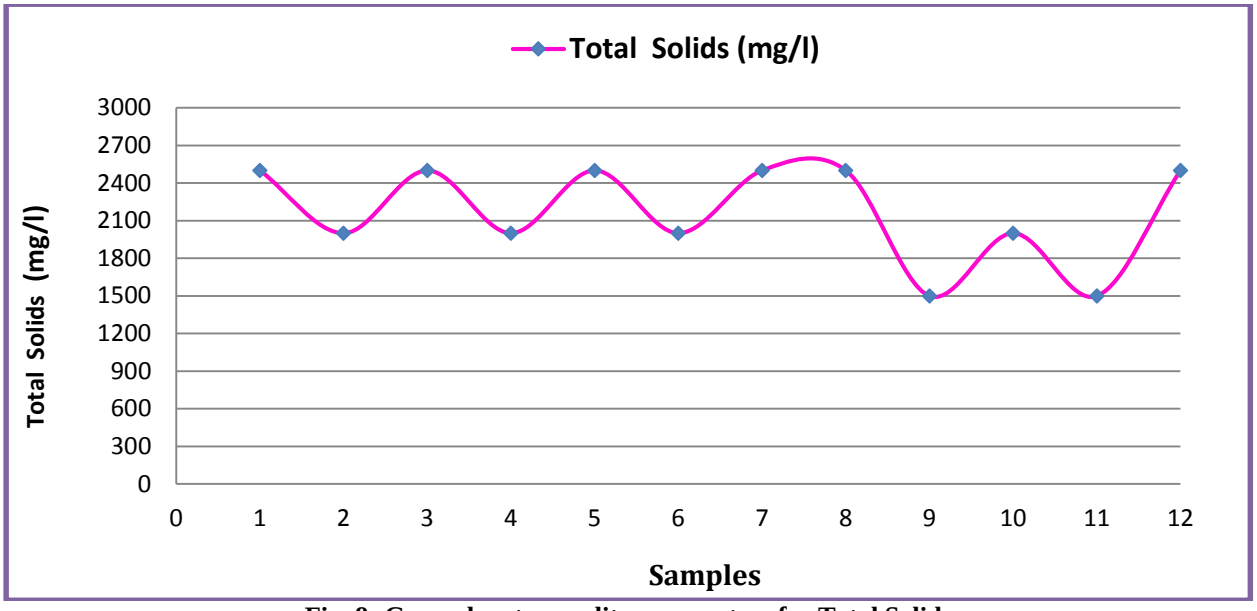

Fig. 8: Ground water quality parameters for Total Solids

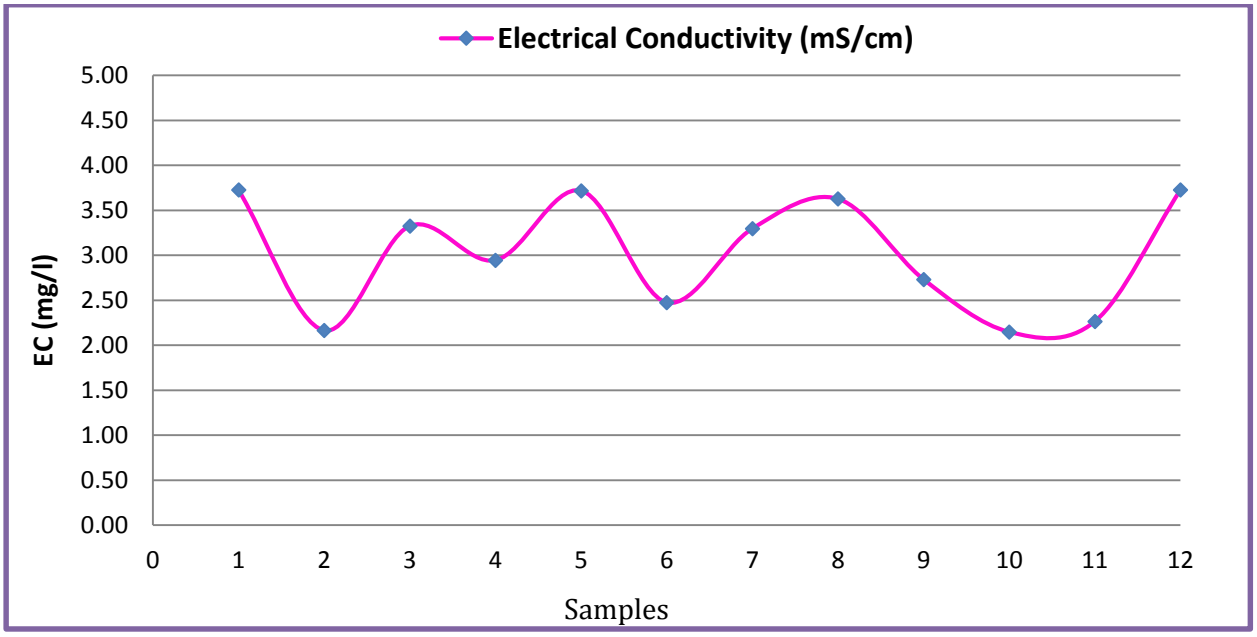

Fig. 9: Ground water quality parameters for Electrical Conductivity

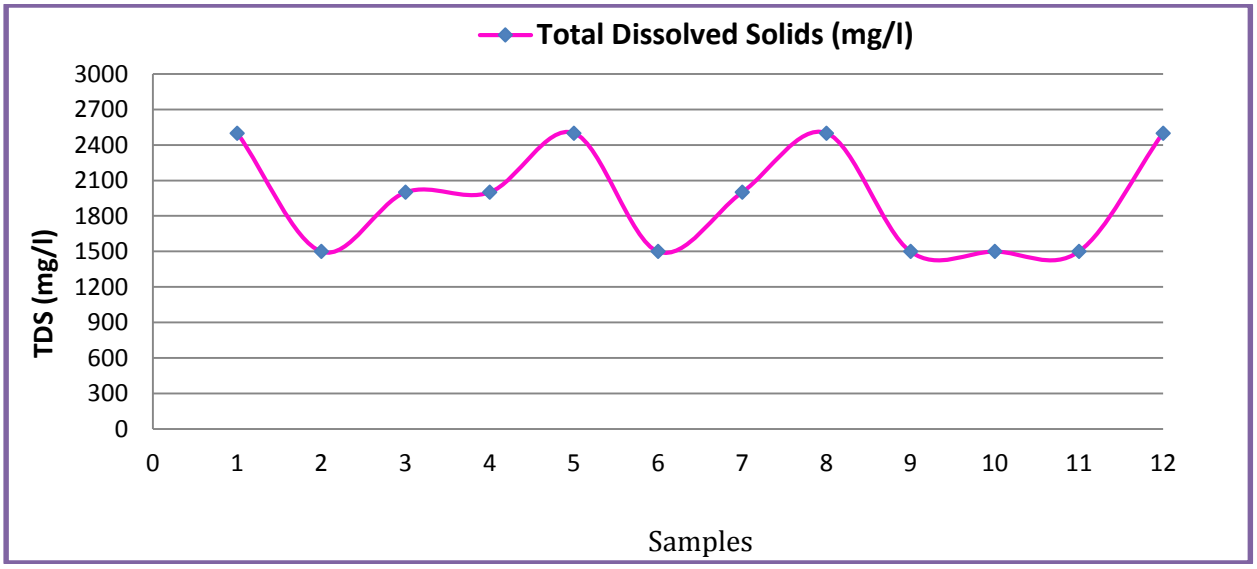

Fig. 10: Ground water quality parameters for TDS

6. WATER QUALITY INDEX

Water Quality Index (WQI) provides information about water quality in a single value. WQI is commonly used for the detection

and evaluation of water pollution and may be defined as a reflection of the composite influence of different quality parameters on the overall quality of water (Horton, 1965). WQI indices are broadly classified into two types; they are physico-chemical and biological indices. The physico-chemical indices are based on the values of various physico-chemical parameters in a water sample, while biological indices are derived from the biological information. Here an attempt has been made to calculate the water quality index of the study area based on physico-chemical data.

Table 4: Ground Water Quality Parameters of the Study Area (Khapri Village)

Samples	Ground WQI
1	33.842
2	19.075
3	36.904
4	48.603
5	80.218
6	37.767
7	43.688
8	38.833
9	56.529
10	39.680
11	38.712
12	20.972

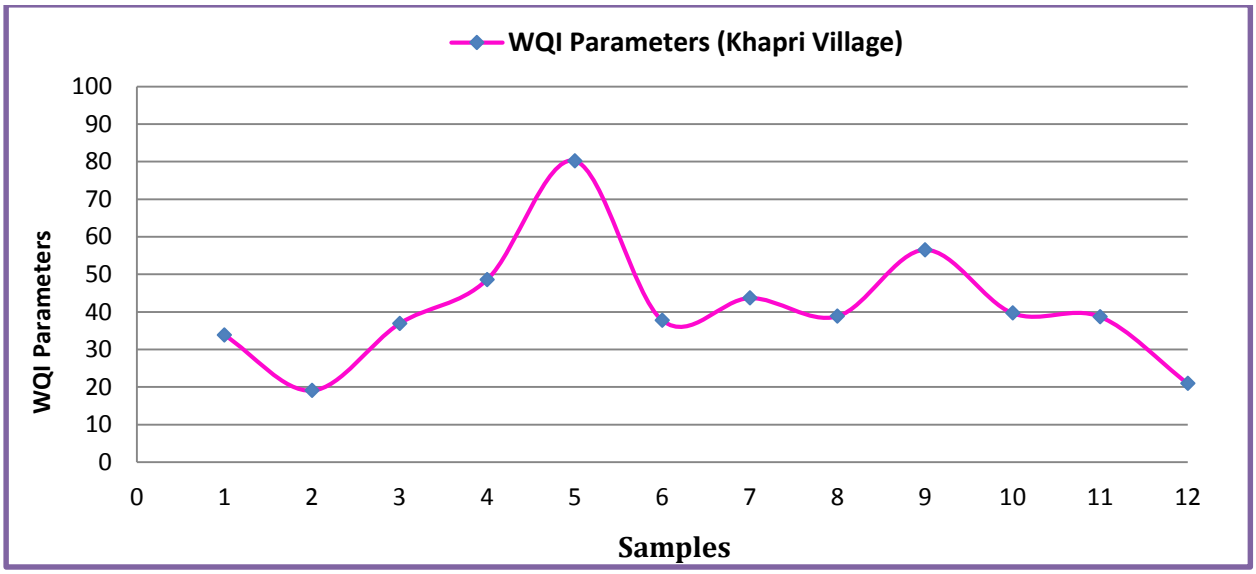

Fig. 11: Ground water quality parameters of the Study Area (Khapri Village)

7. CONCLUSIONS

In this research wor, 12 groundwater samples were assessed for drinking water quality. Analysis has been carried out to study the groundwater characteristics The drinking water quality results of the Khapri Village, show that the highest water quality was recorded at the Sample no 5 (WQI = 80.218) due to the increases in the human population, agricultural activities and it was very close to septic system, whereas the lowest quality found at Sample no 2 (WQI = 19.075). These water samples were fit for drinking without proper treatment according to standard WHO.

8. REFERENCES

[1] Aghazadeh, N and Mogaddam, AA 2010, 'Assessment of Groundwater Quality and its Suitability for Drinking and Agricultural Uses in the Oshnavieh Area, Northwest of Iran', Journal of Environmental Protection, vol. 01, no. 01, pp. 30-40.

[2] Ahamed, AJ and Jayakumar, KLR 2015, 'Hydrochemical characteristics and quality assessment of groundwater in Amaravathi river basin of Karur district, Tamil Nadu, South India', Sustain Water Resource Manag, vol. 1, no. 3, pp. 273-291.

[3] Aiman, El, Mohsen, MM and Jahin, HS 2014, 'Statistical estimation of Rosetta branch water quality using multi-spectral data', Water Science, vol. 28, pp. 18-30.

[4] Ako, A, Gloria, A, Takem, E, Jun, E and Katsuaki, S 2014, 'Nitrate contamination of groundwater in two areas of the Cameroon Volcanic Line Banana Plain and Mount Cameroon area', Applied Water Science, vol. 04, pp. 99-113.

[5] Al-Ahmadi, M and Subyani, 2010, 'Multivariate Statistical Analysis of Groundwater Quality in Wadi Ranyah, Saudi Arabia', Journal of King Abdulaziz University-Earth Sciences, vol. 21, no. 2, pp. 29-46.

[6] Al-Ahmadi, ME 2013, 'Groundwater quality assessment in Wadi Fayd, Western Saudi Arabia', Arabian Journal of Geosciences, vol. 6, no. 1, pp. 247-258.

[7] APHA 2005, Standard methods for the estimation of water and waste water, 21st edn. American Public Health Association, Washington, DC.

[8] Arafath, Y and Kumar, P 2014, 'Analysis of pollutants present in the ground water due to Leachates at Thuraipakkam Dumpyard, Chennai', Civil and Environmental Research, vol. 6, no. 6, pp. 55-61.

[9] Aris, AZ, Abdullah, MH, Ahmed, A and Woong, KK 2007, 'Controlling factors of groundwater hydrochemistry in a small island‟s aquifer', International Journal of Environmental Science and Technology, vol. 4, no. 4, pp. 441-450.
[10] Ayuba, R, Omonona, OV and Onwuka, OS 2013, 'Assessment of groundwater quality of Lokoja basement area, North-Central Nigeria', Journal of the Geological Society of India, vol. 82, no. 4, pp. 413-420.
[11] Basamba, TA, Sekabira, K, Kayombo, CM and Ssegawa, P 2013, 'Application of Factor and Cluster Analyses in the Assessment of Sources of Contaminants in Borehole Water in Tanzania', Pol. J. Environ.Stud., vol. 22, no. 2, pp. 337-346.
[12] Belkhiri, L and Mouni, L 2012, 'Hydrochemical analysis and evaluation of groundwater quality in El Eulma area, Algeria', Applied Water Science, vol. 2, pp. 127-133.
[13] Belkhiri, L and Narany, TS 2015, 'Using Multivariate Statistical Analysis, Geostatistical Techniques and Structural Equation Modeling to Identify Spatial Variability of Groundwater Quality', Water Resources Management, vol. 29, no. 6, pp. 2073-2089.
[14] Ben, M, Salwa, A and Thouraya, S 2014, 'Suitability assessment of deep groundwater for drinking and irrigation use in the Djeffara aquifers Northern Gabes, south-eastern Tunisia', Environ Earth Sci, vol. 71, pp. 3387-3421.
[15] Bureau of Indian Standards BIS 10500 2009, „Indian Standard Drinking Water – Specification‟ Second Revision.
[16] Brima, EI 2014, 'Physicochemical properties and the concentration of anions, major and trace elements in groundwater, treated drinking water and bottled drinking water in Najran area, KSA', Applied Water Science.DOI.10.1007/s 13201-014-0255-x

