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Physicochemical Analysis of Groundwater of Khora Village of Neemkathana Block Sikar, (Rajasthan) India

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ABSTRACT

Groundwater is one of the major resources of drinking water in Khora village in Neemkathana, Sikar. In the present study groundwater quality of the selected Village, nearby Neemkathana Block was taken for investigation by groundwater samples collected by hand pump and assessed for suitability for human consumption. Physico-chemical parameters pH, total alkalinity, total hardness, chloride, fluoride, nitrate, sulphate, and total dissolved solid (TDS) selected for estimation and compared with BIS (IS 10500:2012) during different months of the pre-monsoon, monsoon, and post-monsoon seasons in Jan-2017–Dec-2017.
Keywords : TDS, Physico-chemical parameters pH, total alkalinity, total hardness, chloride, fluoride, nitrate, sulphate,

I. INTRODUCTION

Groundwater composition in an area depends on natural (such as the wet and dry deposition of atmospheric salts, evapotranspiration, and soil/rock–water interactions) and of anthropogenic processes (Leung et al. 2005). Groundwater is an important source of water for drinking, agricultural, and industrial purposes. It contains over 90% of the freshwater resources and is an important reserve of good-quality water. The availability of water determines the location and activities of humans in an area and our growing population is placing great demands upon natural freshwater resources [1]. The extent and type of chemical contamination of the groundwater is largely dependent on the geochemistry of the soil through which water flows while reaching the aquifers (Johnson 1979). According to Zhu et al. (2007) fluoride in drinking water is known for both beneficial and detrimental effects on health. Its concentration in the environment is highly variable and is often dependent on the presence of particular types of rocks, minerals, and water. Siddiqui et al.(2011) attempted to observe the impact of the cement industry on the groundwater quality in the vicinity of the plant. Agricultural, industrial and manufacturing activities contribute tons of hazardous waste per year to the environment (Adewolu et al. 2009). The aim of this study was to determine the Physico-chemical analysis of the groundwater source of the Khora village area and to compare with levels obtained with the BIS.

II. Study Area

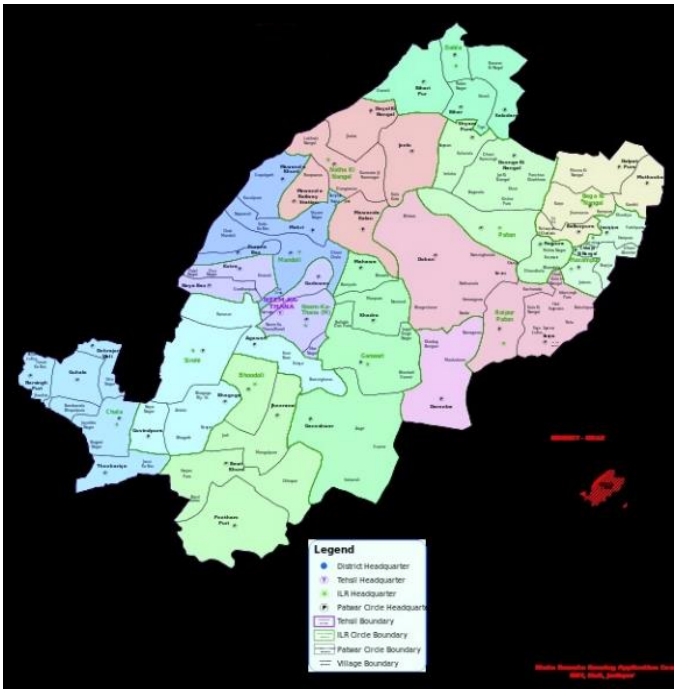

Figure 1 : Khora village Neemkathana block (source: election commission)

The geographical location Khora 27.6649° N, 75.7688° E Neemkathana is nearest town to Khora village which is 8 km away. Hydrological formation of village is Older Alluvium. Due to unavailability of surface water peoples of village are dependent on groundwater. CGWB report states that the groundwater level of village is 40m bgl.

III. Material and Methods

Table 1 : List of Parameters and Methods of Determination

Parameters	**Methods of determination**
pH	pH Meter
TH (mg/l)	EDTA Method
Ca (mg/l)	Titration Method
Mg (mg/l)	Titration Method
TDS (mg/l)	Potentiometric Method
F^- (mg/l)	UV Spectrophotometric Method
SO_4^{2-} (mg/l)	Turbid meter Method
NO_3^- (mg/l)	Spectrophotometer

IV. Results And Discussion

Assessment of groundwater of Khora village in Neemkathana block

Table 2 : Water testing data of Khora village in Neemkathana

Water testing of Khora Village in Neemkathana block								
Month	PH	Total Alkalinity, mg/L $CaCO_3$	Total Hardness, mg/L	Cl^-, mg/L	SO_4^{-2}, mg/L	$NO3^-$, mg/L	F^-, mg/L	TDS, mg/L
Jan-17	7.9	320	350	110	25	62	0.91	1520
Feb-17	7.5	380	340	95	45	70	1.02	1253
Mar-17	7.9	340	410	80	35	58	1.2	1500
Apr-17	7.6	380	500	110	40	65	0.82	1233
May-17	7.2	350	360	100	42	64	1	1155
Jun-17	7.1	360	390	95	34	70	1	1420
Jul-17	7.9	380	380	95	40	65	0.9	980
Aug-17	8	350	370	105	41	64	0.9	950
Sep-17	7.9	310	395	104	45	60	0.95	970
Oct-17	8.1	300	410	90	38	62	1.2	950
Nov-17	7.6	290	380	90	38	64	1	900
Dec-17	7.7	310	400	95	35	68	1.2	950

Table 2 includes the testing results of groundwater in Khora village for selected parameters, for the assessment period of Jan-17 to Dec-17. Parameter pH has no unit while all the selected parameters are shown in mg/L. For the assessment of the groundwater parameters, BIS (IS 10500:2012) is selected which have accepted, and permissible limits for each parameter, with no relaxation for nitrate.

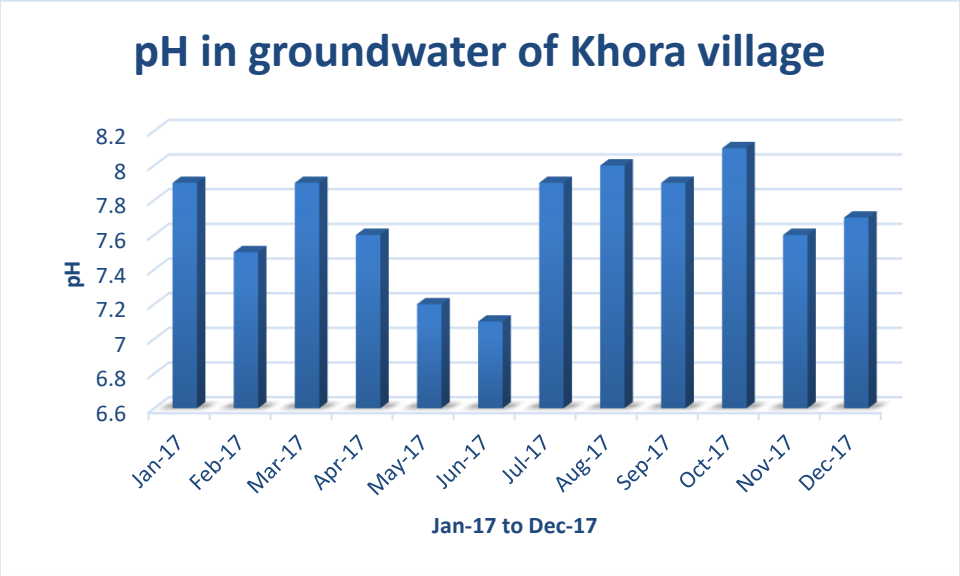

Figure 2 : pH of groundwater in Khora village of Neemkathana block

Figure 2 shows the variation of pH value for the assessment year varying between 7.1 - 8.1. The minimum pH of 7.1 was observed in the month of June 17, and the maximum pH of 8.1 was observed on the month of Oct-17. The mean value for pH is 7.7, and the pH of the groundwater of Khora village was also observed within the (BIS IS 10500: 2012) acceptable limit of 6.5 – 8.5.

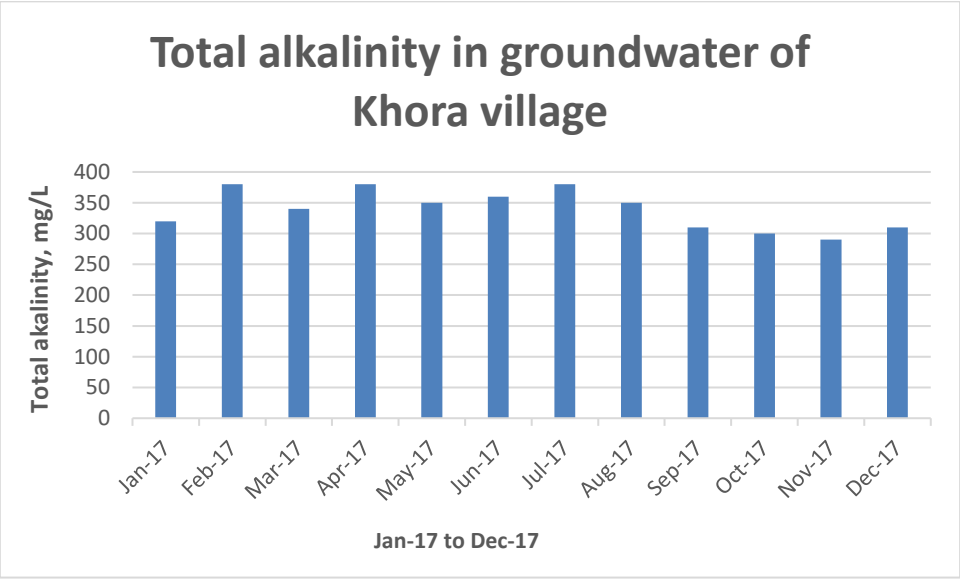

Figure 3: Total alkalinity in groundwater of Khora village in Neemkathana block

Figure 3 shows that the total alkalinity variation for the assessment period Jan-17 to Dec-17 is 290 mg/L-380 mg/L. The maximum total alkalinity of 380 mg/L (as $CaCO_3$) is observed in the month of Feb, April, and July 17, and the minimum total alkalinity of 290 mg/L is observed in the month of Nov-17. The mean value for the

assessment period is 339.16 mg/L, The total alkalinity of groundwater in the Khora was village observed higher than the BIS (IS 10500: 2012) acceptable limit of 200 mg/L (as $CaCO_3$).

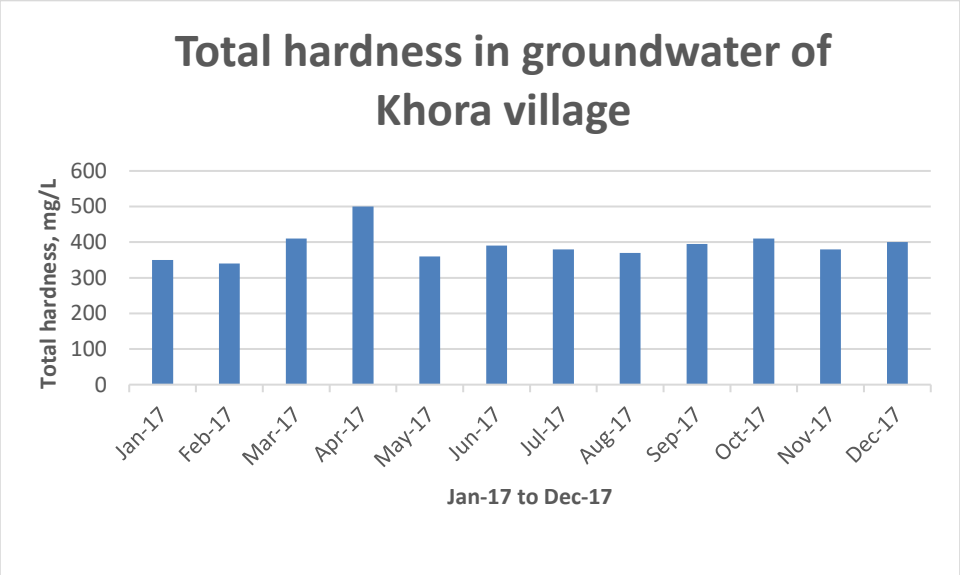

Figure 4: Total hardness in groundwater of Khora village in Neemkathana block

Figure 4 shows that the total hardness (as $CaCO_3$) variation for the assessment period Jan-17 to Dec-17 is 340 mg/L-500 mg/L. The maximum total hardness of 500 mg/L was observed in the month of April 17, and the minimum total hardness of 340 mg/L is observed in the month of Feb-17. The assessment parameter mean value is 390.45 mg/L observed slightly high than the BIS (IS 10500: 2012) acceptable limit of 200 mg/L.

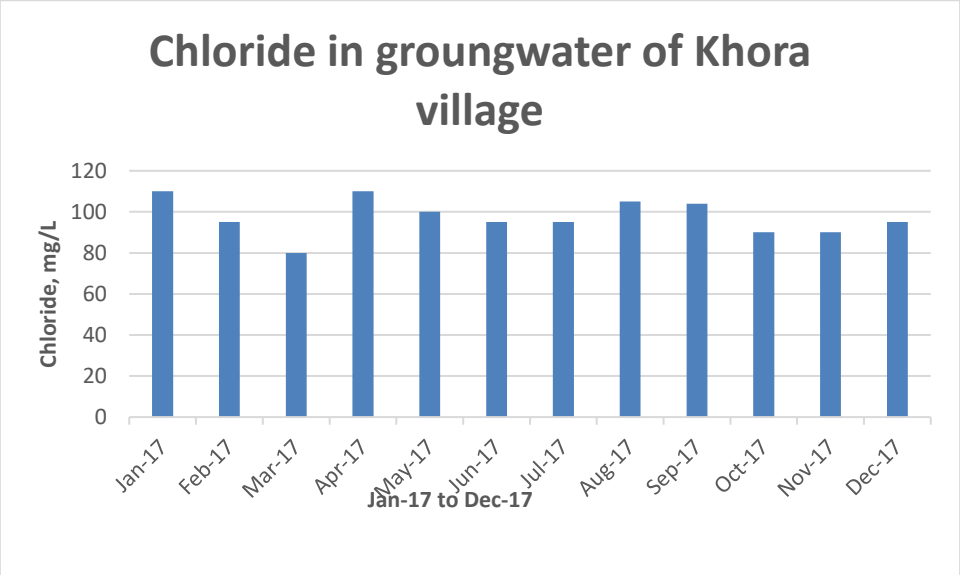

Figure : Chloride in groundwater of Khora village in Neemkathana block

Figure 4 shows that the chloride concentration variation for the assessment period Jan-17 to Dec-17 is 80 mg/L-110 mg/L. The maximum chloride of 110 mg/L was observed in the month of April 17 and the minimum chloride concentration of 80 mg/L is observed in the month of March 17. The mean value for the parameter is 97.41 mg/L, which is within the BIS (IS 10500: 2012) acceptable limit of 250 mg/L.

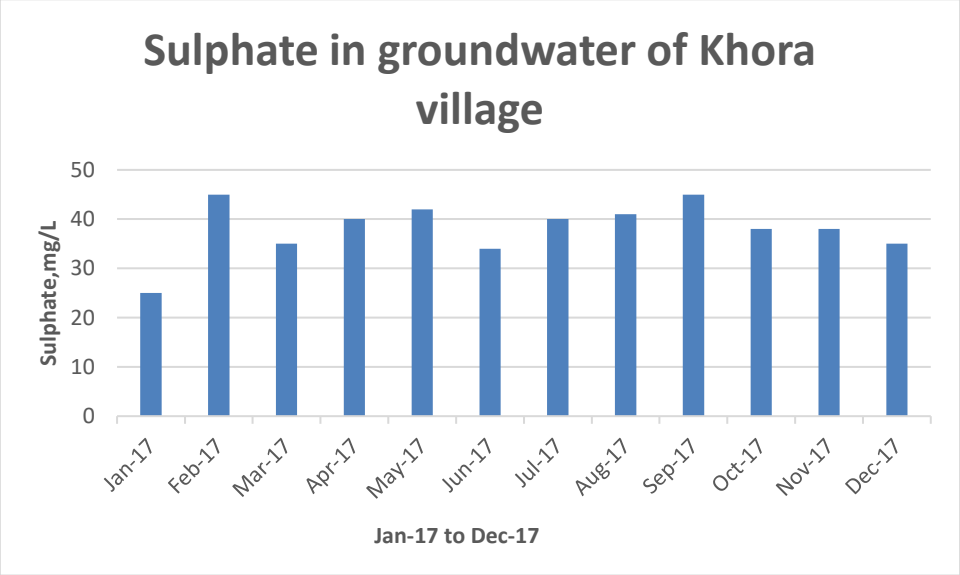

Figure 6: Sulphate in groundwater of Khora village in Neemkathana block

Figure6 shows that the sulphate concentration variation for the assessment period Jan-17 to Dec-17 is 25 mg/L-45 mg/L. The maximum sulphate 45 mg/L observed in the month of Feb-17 and Sept-17 and the minimum sulphate 25 mg/L is observed in the month of Jan-17. The mean value for the assessment period is 38.86 mg/L is within the BIS (IS 10500: 2012) acceptable limit of 200 mg/L.

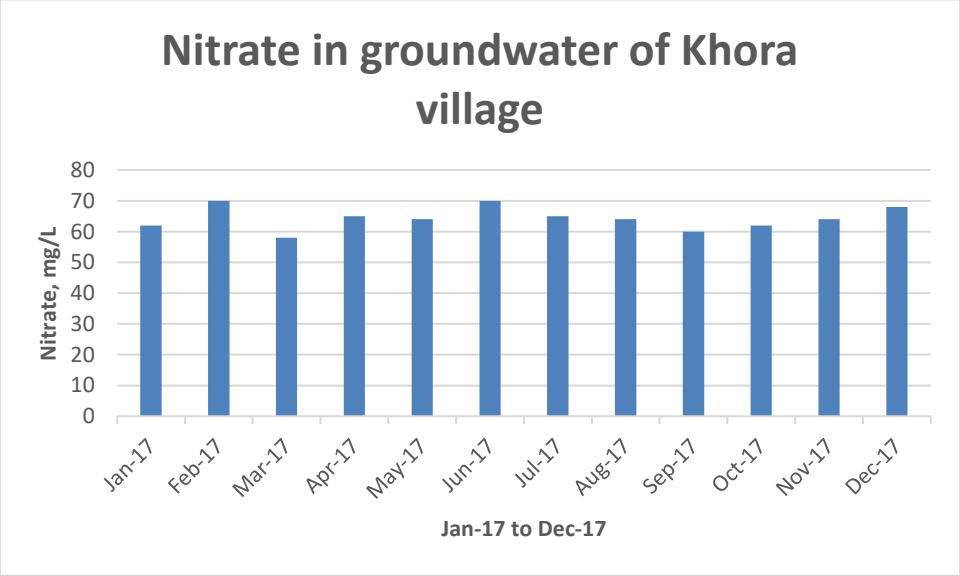

Figure 7: Nitrate in groundwater of Khora village in Neemkathana block

Figure 7 shows that the nitrate concentration variation for the assessment period Jan-17 to Dec-17 is 58 mg/L-70 mg/L. The maximum nitrate 70 mg/L observed in the month of Feb-17 and June-17, and the minimum 58 mg/L nitrate is observed in the month of March-17.The mean value for nitrate is 64.33 mg/L, and is higher than the BIS (IS 10500: 2012) acceptable limit of 45 mg/L.

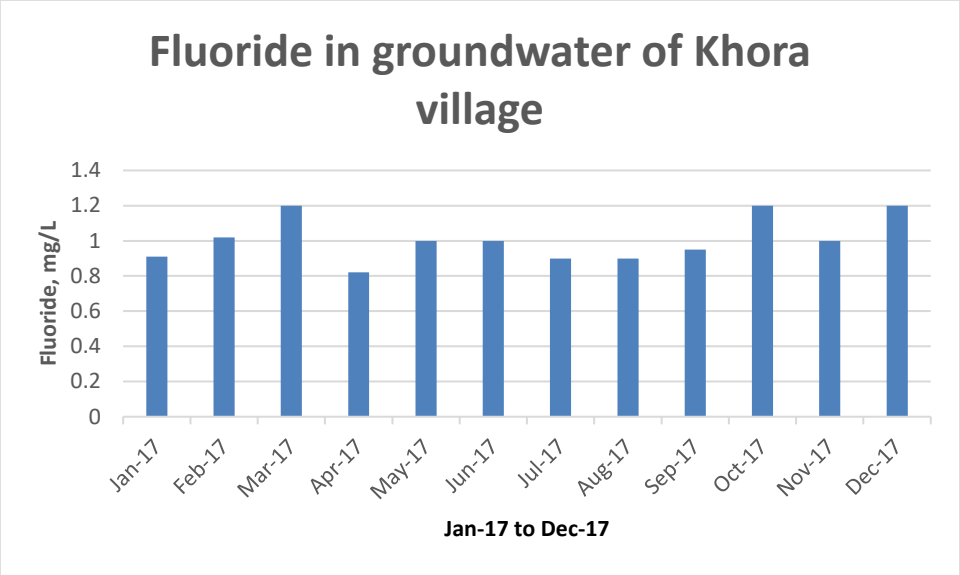

Figure 8: Fluoride in groundwater of Khora village in Neemkathana block

Figure 8 shows that the fluoride concentration variation for the assessment period Jan-17 to Dec-17 is 0.82 mg/L -1.2 mg/L. The maximum fluoride is 1.2mg/L observed in the month of March, Oct, and Dec-17 and the minimum fluoride of 0.82 mg/L is observed in the month of April 2017. The mean value of the parameter for the assessment period is 1.00 mg/L, is higher than the BIS (IS 10500: 2012) acceptable limit of 1.0 mg/L, and a permissible limit of 1.5 mg/L. is higher than the BIS (IS 10500: 2012) acceptable limit of 1.0 mg/L, and a permissible limit of 1.5 mg/L.

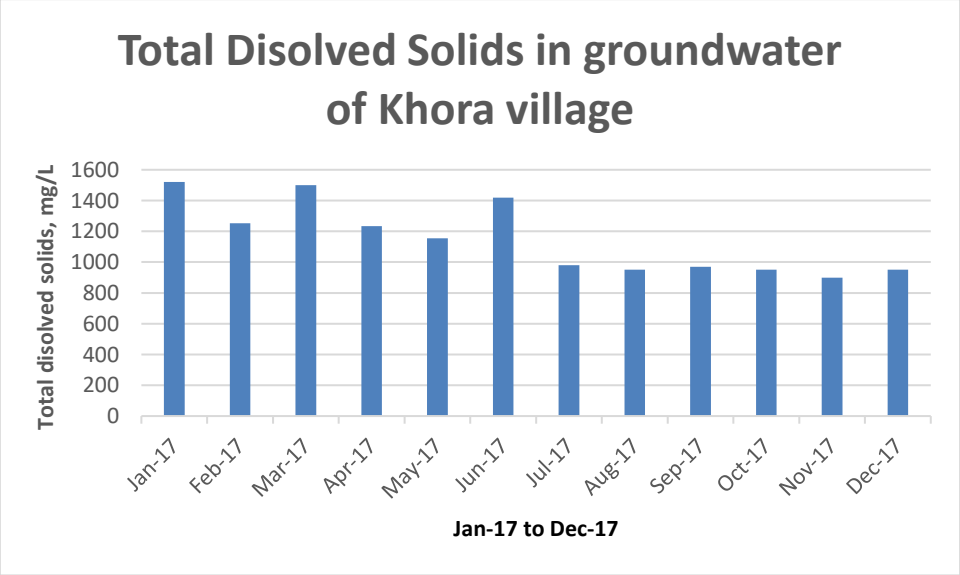

Figure 9: TDS in groundwater of Khora village in Neemkathana block

Figure 9 shows that the Total Dissolved Solids (TDS) variation for the assessment period Jan-17 to Dec-17 is 900 mg/L-1520 mg/L. The maximum TDS of 1520 mg/L was observed in the month of Jan-17 and the minimum TDS of 900 mg/L is observed in the month of Nov 17. The mean value for the assessment period of TDS is 1148.4 mg/L, TDS higher than the BIS (IS 10500: 2012) acceptable limit of 500 mg/L for the whole year with an irregular trend of variation.

V. CONCLUSION

Assessment of physico-chemical parameters for groundwater states the suitability for domestic use for groundwater. The total alkalinity of groundwater in the Khora was village observed as higher than the BIS (IS 10500: 2012) acceptable limit of 200 mg/L (as CaCO3). The assessment parameter mean value for total hardness is 390.45 mg/L observed slightly high than the BIS (IS 10500: 2012) acceptable limit of 200 mg/L. The mean value for the parameter chloride is 97.41 mg/L, which is within the BIS (IS 10500: 2012) acceptable limit of 250 mg/L. The mean value for the assessment period for sulphate is 38.86 mg/L is within the BIS (IS 10500: 2012) acceptable limit of 200 mg/L. The mean value for nitrate is 64.33 mg/L and is higher than the BIS (IS 10500: 2012) acceptable limit of 45 mg/L. Assessment results indicate that the overall quality of water in Khora village is poor. The state government and central government should implement some major to prevent overexploitation of groundwater in this area.

VI. REFERENCES

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