

GLOBAL JOURNAL OF ADVANCED ENGINEERING TECHNOLOGIES AND SCIENCES**“ASSESSMENT OF GROUND WATER SAMPLES FOR PHYSICO-CHEMICAL PARAMETERS FROM VARIOUS AREAS OF REWARI (HARYANA)”****Kapil Singh*, Dr Sunita Singh Shekhawat, Dr Alka Choudhary, M. S. Zubairu,
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ABSTRACT

Due to human and industrial activities, ground water is contaminated. The present paper deals with the assessment of ground water samples for Physico-chemical parameters from various areas of district Rewari (Haryana). The following 15 parameters have been considered viz. Total Hardness, pH, Electrical Conductivity, Total Dissolved Solids, Alkalinity, Fluoride, Chloride, Sulphate, Nitrate, Phosphate, Lead, Zinc, Iron, Cadmium and Dissolved Oxygen by various analytical techniques. On comparing the results against drinking quality standards laid by [IS-10500:1991 BIS]. It was found that some of the water quality parameters were above the permissible limit and some were not. Alkalinity and Total Dissolved Solids levels are found extremely higher than permissible limits. High level of TDS and alkalinity causes objectionable taste and laxative effect. The most of the samples does not contain the concentration of Lead.

KEYWORDS: Physico-chemical, concentration, analytical technique, Total Hardness, Alkalinity.**INTRODUCTION**

The water is one of the most important part of the ecosystem. Living things exist because of this is the only planet that has the existence of water. It is essential for the survival of all the living things be it plant or animal life. Water is the most abundant commodities in nature but also the most misused one. Although earth is a blue planet and 80% of earth's surface is covered by water, the hard fact of life is that about 97% is locked in oceans and sea which is too saline to drink and direct use for agricultural or industrial purposes. 2.4% is trapped in polar icecaps and glaciers, from which icebergs break off and slowly melt at sea and oceans. Also due to increased human population, use of fertilizers in the agriculture and manmade activities, the natural aquatic resources causes heavy and varied pollution in aquatic environment leading to depletion of aquatic biota ^[1].

Water of good drinking quality is of basic importance to human physiological cycle and man's continued existence depends very much on its availability ^[2]. The WHO report that approximation 36% of urban and 65% of rural Indians were without access to safe drinking water ^[3]. Ground water is the most important source of supply for drinking, irrigation and industrial purposes. Increasing population and its necessities have led to the deterioration of surface and sub-surface water ^[4]. Monitoring of water quality levels is thus important to assess the levels of pollution and also to assess the potential risk to the environment ^[5].

Fresh water has become a scarce commodity due to over exploitation and pollution of water. Increasing population and its necessities have led to the deterioration of surface and sub-surface water. Groundwater is major source of the drinking water in both urban and rural areas. Groundwater is very important for the existence of human society and industrial sector from times immemorial ^[6]. The quality of ground water is affecting due to rapid increasing of population, urbanization, industrialization and use of fertilizers in the agriculture fields leads to water borne diseases ^[7-8]. Therefore, it is always needed to check regularly the ground water quality because groundwater comes out through various conditions ^[9].

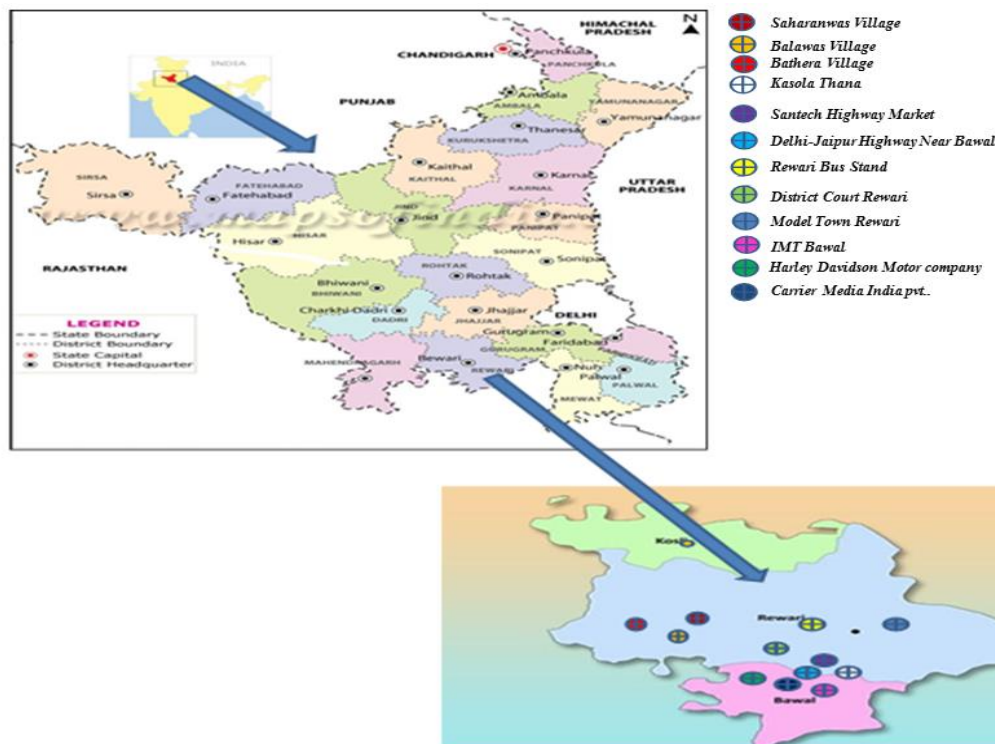
MATERIALS AND METHODOLOGY***Collection of water samples***

The water samples were collected in washed plastic bottles. These bottles were covered immediately after collection of the samples. The various ground water samples from Industrial, Roadside, Commercial and Remote Residential areas of Rewari have been collected from IMT Bawal (WSI-1), Harley Davidson Motor

Company (WSI-2), Carrier Media India PVT (WSI-3), Rewari Bus Stand (WSC-1), District Court Rewari (WSC-2), Model Town Rewari (WSC-3), Kasola Thana (WSRS-1), Santech Highway Market (WSRS-2), Delhi-Jaipur Highway near Bawal (WSRS-3), Saharanwas (WSR-1), Balawas (WSR-2) and Bathera village (WSR-3) areas of Rewari, Haryana. At least three samples from different sources of ground water were collected from each site to get exact result. Table 1 shows different analytical water quality parameters with their analytical techniques.

Table 1: Different analytical water quality parameters with their analytical techniques.

Sr. No.	Parameter	Technique used
1	Nitrate	Chromotropic acid method
2	Sulphate	Turbidimetric Method
3	Alkalinity	Titration method
4	pH	pH metry
5	Total Dissolved Oxygen	Filtration Method
6	Cadmium	Atomic Absorption Spectrometry
7	Iron	Atomic Absorption Spectrometry
8	Zinc	Atomic Absorption Spectrometry
9	Lead	Atomic Absorption Spectrometry
10	Total Hardness	Complexometric Titration using EDTA method
11	Dissolved Oxygen	Wrinkler's method
12	Electrical Conductivity	Conductivity Metry
13	Fluoride	Spectrometric method
14	Chloride	Argentometric method
15	Phosphate	UV/Visible Spectrophotometry



Determination of Nitrate

Nitrate was determined by Chromotropic acid method. Into a series of 100 ml of standard flask add nitrate working solution, up to 1ml in each flask. Added 1ml of Brucine sulfanilic acid and 10 ml of dilute H₂SO₄, and kept in dark for 10 minutes. This was followed by addition of 30 ml distilled and kept again in dark for 30 minutes. Then added distilled water to mark of standard flask and analysed at 410nm.

Determination of Alkalinity

10 ml of sample was taken into a conical flask. 1 drop of sodium thiosulfate and two drops of phenolphthalein indicator were added. The solution was titrated against N/10 sulphuric acid till the colour just disappeared. Then addition of two drops of methyl orange was done. Again titrated against sulphuric acid until the colour turns orange yellow, noted the readings.

Determination of pH

pH was determined by electrometric method i.e., digital pH meter [Labtronics 11, serial No. 201103048] using standard buffer solutions. The samples were analysed, established equilibrium between electrode and sample stirring homogeneity and measured pH level.

Determination of TDS

The Total Dissolved Solids was determined by filtration method. 10 mL liquid is carefully transferred to a weighed platinum dish with the help of policeman and wash with distilled water. Evaporate the solution to dryness on steam bath and dry the dish in an oven at about 100 -118°C for about an hour. Cool it in desiccator and weigh.

Determination of Phosphate, Fluoride and Sulphate

The concentration of Phosphate, Fluoride ions and Sulphate of the samples were determined by using UV-Visible spectrophotometer (Model 2202, Systronics) using standard solutions and analysed at 420 nm, 325 nm, and 371 nm respectively.

Determination of Lead (Pb), Cadmium (Cd), Zinc (Zn) and Iron (Fe)

The samples were digested using 2% HNO₃ and then analysed by Atomic Absorption Spectrometer for Lead, Cadmium, Zinc and Iron on air-acetylene flame at wavelength 283.2 nm, 228.8 nm, 213.86 nm and 324.75nm, respectively.

Total Hardness

Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water. The total Hardness was analysed by Complexometric titration using EDTA and Eriochrome black T indicator until the change from wine red to blue.

$$\text{Hardness (mg/L)} = \frac{A \times B \times 1000}{\text{ml of Sample taken}}$$

Where A= ml of EDTA for titration,

B= mg of CaCO₃equivalent to 1ml of EDTA.

Dissolved Oxygen (DO)

Determination of Dissolved Oxygen (DO) is very important need for living organisms to maintain their biological process. Determination of Dissolved Oxygen will be done using Sodium Thiosulphate solution and Manganous Sulphate solution.

Electrical Conductivity

The instrument was warmed for 10 minutes and calibrated using KCl solution. Electrical Conductivity of different samples was measured by conductivity meter.

Determination of chloride

10ml of water sample was taken, added 1ml of K₂CrO₄ (an indicator) then solution turned in yellow. Titrated against AgNO₃. Red-Brown colour is appeared in solution or white precipitation is found due to the presence of chloride.

RESULTS AND DISCUSSION

Physico-chemical parameters analysed for the selected samples is shown in Table 2.

Table 2: Physico-chemical parameters of selected ground water samples

Sr. No.	SAMPLING SITES	WSR1	WSR2	WSR3	WSRS1	WSRS2	WSRS3	WSC1	WSC2	WSC3	WSI1	WSI2	WSI3
1	Nitrate(mg/L)	38.43	42.68	71.19	54.11	46.21	42.68	57.33	152.84	29.85	188.09	96.95	71.19
2	Sulphate(mg/L)	111.91	25.19	305.71	85.24	67.13	52.04	136.16	360.07	93.46	341.22	179.82	293.61
3	Alkalinity(mg/L)	170	540	160	550	360	600	380	620	600	1920	2620	2000
4	pH	7.5	7.3	7.4	9.0	5.7	7.3	7.2	6.5	5.3	8.4	11.9	9.4
5	TDS(ppm)	1270	920	1500	240	680	360	290	530	590	1600	2200	1920
6	Cadmium(mg/L)	4.973	0.0025	0.192	NA	NA	4.824	18.57	NA	47.70	0.337	NA	19.14
7	Iron(mg/L)	NA	4.983	0.738	NA	NA	2.707	NA	0.475	2.660	3.414	NA	4.667
8	Zinc(mg/L)	10.25	10.87	11.89	11.91	12.17	12.93	12.93	10.34	7.798	12.42	7.000	9.481
9	Lead(mg/L)	NA	NA	NA	NA	NA	NA	NA	7.852	8.115	NA	NA	NA
10	Total Hardness (ppm)	108	132	160	180	68	96	128	124	120	184	148	152
11	DO(ppm)	2.8	2.4	2.6	0.9	0.7	1.8	3.1	2.8	2.6	3.8	4.0	3.7
12	E.C.(mhos/cm)	0.445	0.411	1.919	0.972	0.597	0.543	0.673	1.290	0.230	1.919	1.221	0.772
13	Fluoride(mg/L)	1.42	2.47	2.03	0.35	0.81	0.24	1.63	0.82	0.21	0.57	2.60	0.46
14	Chloride(mg/L)	190.28	90.88	144.84	266.96	235.72	318.08	88.04	82.36	71.00	79.52	380.56	326.60
15	Phosphate(mg/L)	0.04	0.05	0.26	2.07	0.95	0.01	0.68	0.43	3.82	1.34	0.89	1.78

Nitrate

Figure 2(a) shows the concentration of nitrate in various water samples from collected areas. The level of nitrate was found from 25.85-188.09 mg/L. The main source of lead in ground water is attributed to contamination of ground water with domestic sewage and livestock facilities, septic system, manure lagoons, fertilizers, household waste water, fertilizers natural deposits and agricultural runoff.

Sulphate

Figure 2(b) shows the concentration of sulphate in various water samples from collected areas. The level of sulphate was found from 25.19-360.07 mg/L. which was in permissible limits (200-400 mg/L). Increased levels of sulphate were due to industrial, anthropogenic additions in the form of sulphate fertilizers and discharge of domestic sewage in water bodies.

Alkalinity

Figure 2(c) shows the concentration of alkalinity in various water samples from collected areas. The level of alkalinity was found from 160-2620 mg/L shows that the minimum value of alkalinity is observed as 160 mg/L in the sample of WSR-3 while the maximum value is 2620 mg/L is observed in the sample WSI-2. This may be due to low water table and lower temperature bringing down the rate of decomposition of salts to a minimum there by increasing the alkalinity. Some of alkalinity levels are found extremely higher than permissible limits. Alkalinity is the sum total of components in the water that tend to elevate the pH to alkaline side of neutrality. Commonly occurring materials in water that increase alkalinity are carbonates, bicarbonates, phosphates and hydroxides.

pH

Figure 2(d) shows the pH levels in different water samples and it has been found that all the selected water samples are slightly alkaline in nature but all the samples are safe for drinking purposes as acceptable permissible limit is up to 8.5 (except WSRS-1, WSI-2 and WSI-3) according to Indian Standards. Highest values are due to addition of effluents or sewage. Most of the water samples are slightly alkaline due to presence of carbonates and bicarbonates.

TDS

Figure 2(e) shows the minimum concentration (240 mg/L) is found in the sample of WSRS-1 while maximum concentration (2200 mg/L) is found in the sample WSI-2. High value is due to the evaporation of or garbage deposition in to water body.

Cadmium

Figure 2(f) shows the cadmium concentration of different sampling sites. It is found that except WSRS-1, WSRS-2, WSC-2 and WSI-2, other water sample contains cadmium levels. The main source of cadmium in ground water is due to contamination of ground water with domestic sewage. The waste from industries engaged in electroplating works, manufacture of textile, fertilizer, plastic etc. are normally rich in toxic trace metals. Beside industrial effluent discharge of untreated sewage in the roadside unlined channels may pollute the ground water due to seepage (line source).

Iron

Figure 2(g) shows the iron levels in various samples. The samples WSR-1, WSRS-1, WSRS-2, WSC-1 and WSI-2 do not contains the concentration of iron. The maximum conc. (4.983 mg/L) has been found in the sites of WSR-2.

Zinc

Figure 2(h) shows that the level of zinc in the collected samples from various sites is found in desirable limits. The value varies from 7.0 mg/L-12.93 mg/L in the samples of WSI-2 and WSRS-3, WSC-1, respectively.

Lead

Figure 2(i) shows the lead contents in various water samples and seen that lead is not found in the sampling sites except of WSC-2 and WSC-3. The main source of lead in ground water is attributed in contamination of ground water with domestic sewage and existence of heavy industries. Lead levels in drinking water are relatively low, because convectional water treatment procedures remove a significant amount of lead. Low pH and softness increases lead content of water by promotion corrosion.

Total Hardness

Figure 2(j) mentioned the total hardness present in the water samples. The total hardness have found in the range between 68 ppm from the sampling site of WSRS-2 and 184 ppm from WSI-1 which is in permissible limits and this water is also safe for drinking as the standard value can relaxed upto 600 ppm according to Indian Standards [IS : 1055] specification. Highest values are due to addition of effluents or sewage. The values of total hardness for all the sampling sites were found in the permissible limit.

Dissolved Oxygen

Figure 2(k) shows the levels of dissolved oxygen and minimum levels (0.7 mg/L) were found in the sample of WSRS-2 while maximum DO level (4.0 mg/L) was observed in the sample of WSI-2. DO values were found highest due to decomposition of organic matter, respiration, presence of iron and rise in temperature.

Electrical Conductivity

Figure 2(l) shows the values of electrical conductivity in water samples. The minimum value (0.230 mhos/cm) was reported in the sample of WSC-3 while maximum value (1.919 mhos/cm) was reported in the sampling sites of WSR-3 and WSI-1.

Fluoride

The fluoride concentration of water samples have been mentioned in figure 2(m). The fluoride concentration have been found in the range between 0.21 mg/L for sampling site WSC-3 and 2.60 mg/L for sampling site WSI-2. The value of fluoride for all sampling sites has been found in the permissible limit.

Chloride

Figure 2(n) shows the chloride levels in various samples. The minimum concentration (71.00 mg/L) have been found in the site WSC-3 and maximum levels (380.56 mg/L) have been found at the site of WSI-2 due to the decrease in water level, evaporation and deposition of company waste. All type of natural and raw water contains chlorides. It comes from activities carried out in agricultural area, Industrial activities and from chloride stones. Its concentration is high because of human activities. All the values of chlorides are in permissible limit.

Phosphate

Figure 2(o) shows the levels of phosphate in the collected samples from various sites. It was found that all water samples contain phosphate levels i.e., minimum and maximum values are in the range of 0.01-3.82 mg/l, respectively, and all values are in permissible limits.

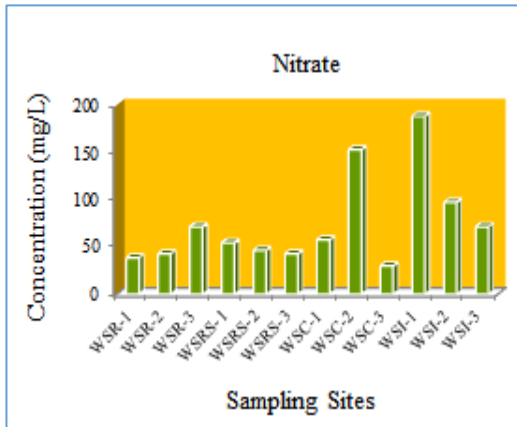


Fig. 2 (a) Graph showing Nitrate values for different water samples

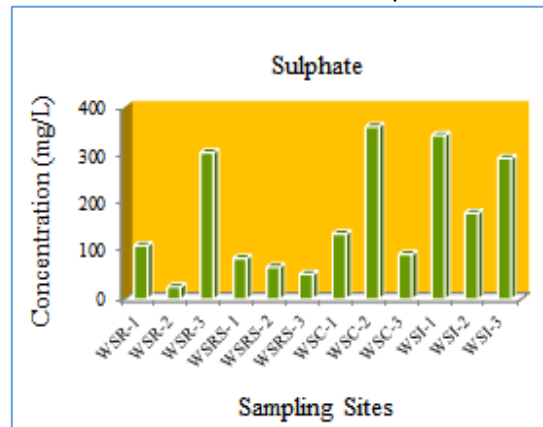


Fig. 2 (b) Graph showing Sulphate values for different water samples

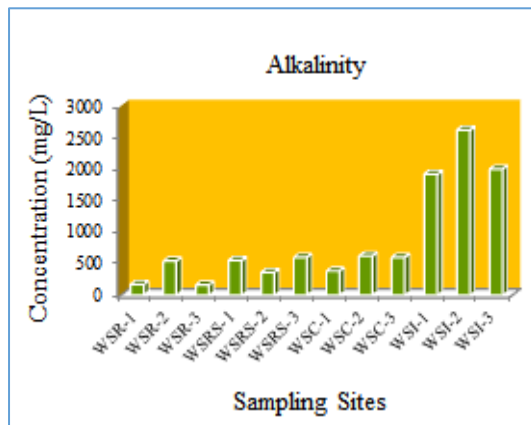


Fig. 2 (c) Graph showing Alkalinity values for different water samples

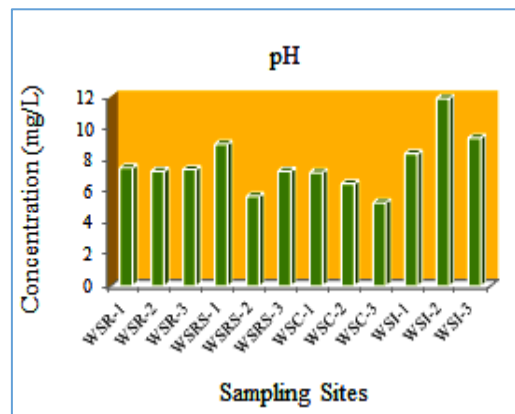


Fig. 2 (d) Graph showing pH values for different water samples

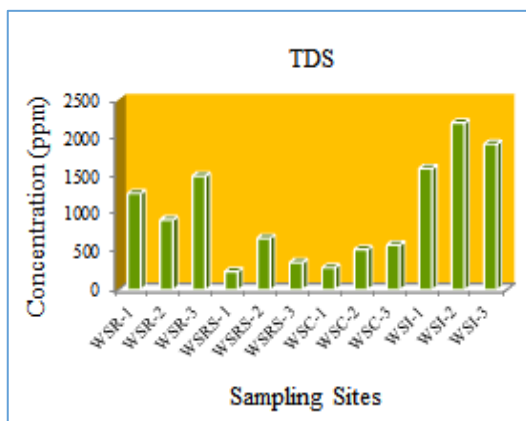


Fig. 2 (e) Graph showing Total Dissolved Solids values for different water samples

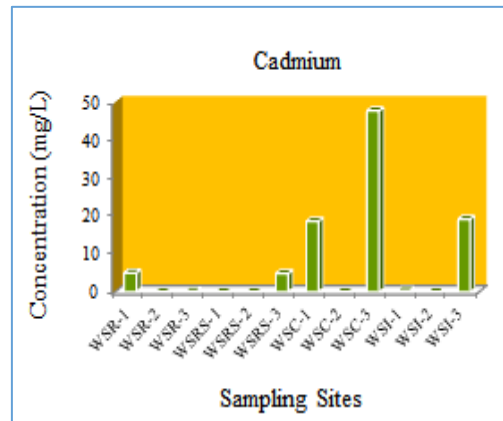


Fig. 2 (f) Graph showing Cadmium values for different water samples.

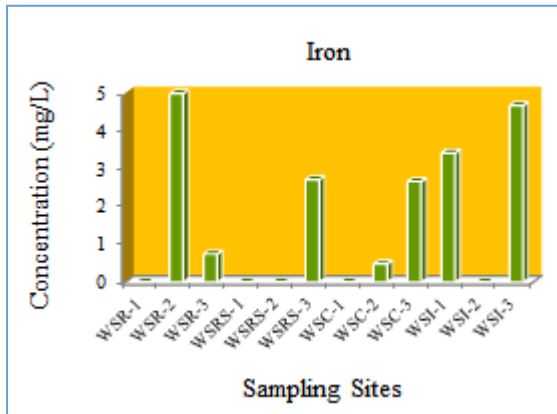


Fig. 2 (g) Graph showing Iron values for different water samples.

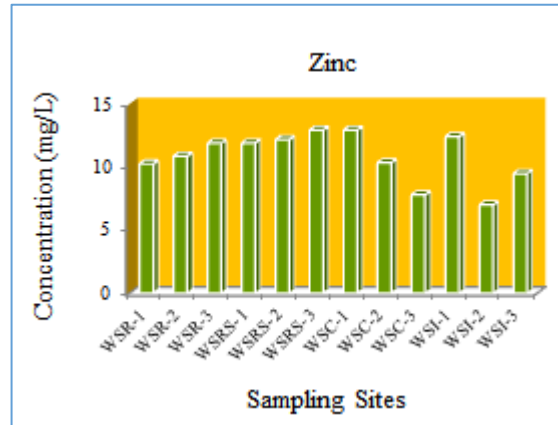


Fig. 2 (h) Graph showing Zinc values for different water samples.

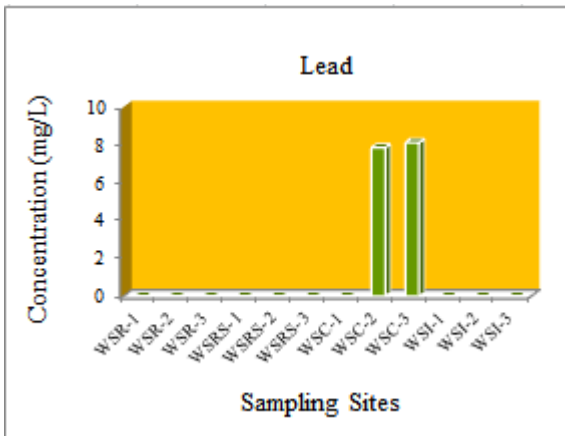


Fig. 2 (i) Graph showing Lead values for different water samples.

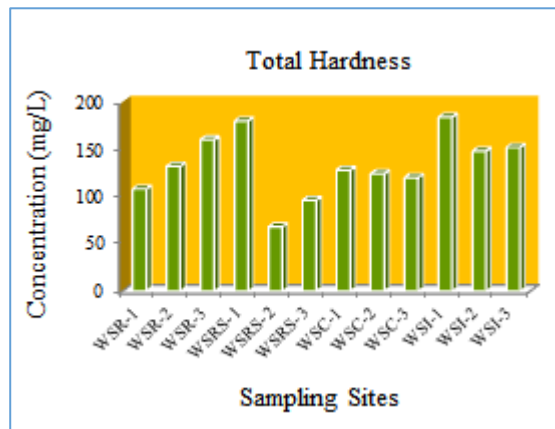


Fig. 2 (j) Graph showing Total Hardness values for different water samples.

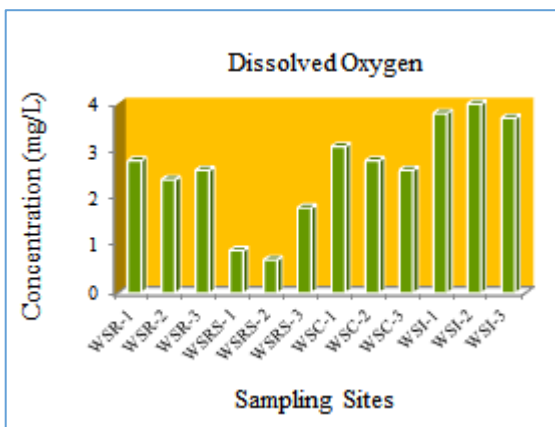


Fig. 2 (k) Graph showing Dissolved Oxygen values for different water samples.

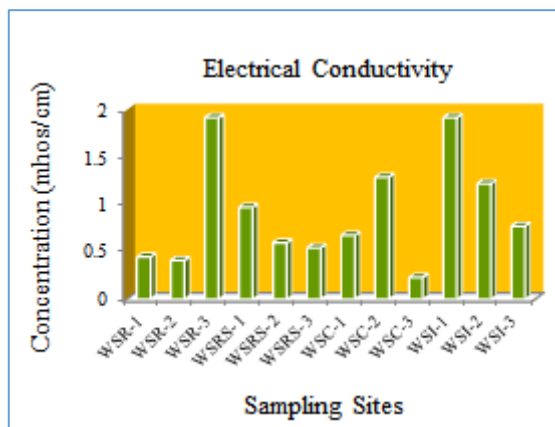


Fig. 2 (l) Graph showing Electrical Conductivity for different water samples.

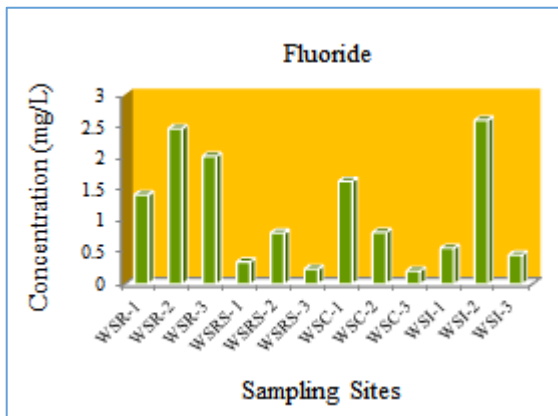


Fig. 2 (m) Graph showing Fluoride values for different water samples.

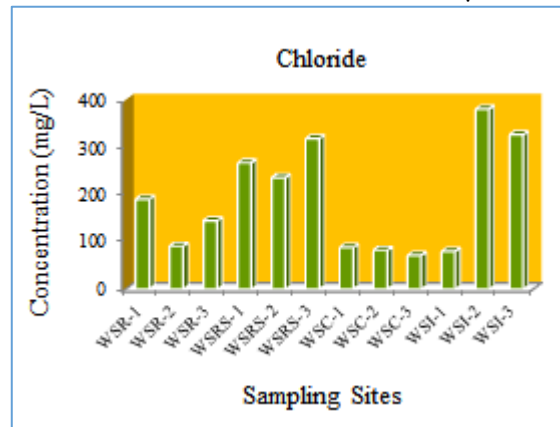


Fig. 2 (n) Graph showing Chloride values for different water samples.

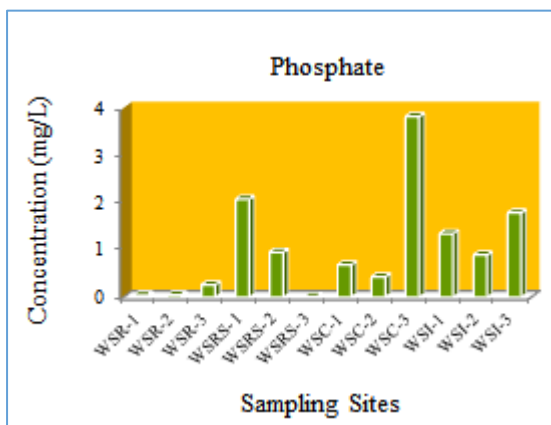


Fig. 2 (o) Graph showing Phosphate values for different water samples.

CONCLUSION

Water quality is dependent on the type of the pollutant added and the nature of mineral found at particular zone of industrial, commercial, residential and roadside. Monitoring of the water quality of ground water is done by collecting representative water samples and analysis of physico-chemical characteristics of water samples at different locations of Rewari city. From our observation we concluded that the levels of Sulphate, Chloride, Phosphate, Zinc, Lead, Total Hardness and Dissolved Oxygen were found in permissible limits. Increase in value of Nitrate, Fluoride, pH and Electrical Conductivity were due to domestic discharges. Increased concentration of heavy metal like Lead, Cadmium and Iron was due to high discharge of water from catchment area, industries and various drains. The samples near the industrial and residential area had higher values of TDS and Alkalinity. High level of TDS and Alkalinity was due to contamination of domestic waste water, garbage and fertilizers etc. Both these contents in water, in increased amount are harmful to living beings. On the basis of the above study and discussion it was concluded that the water in this area had very poor quality and is not fit for drinking purpose. So we can suggest that the water from infected sites should be used after proper treatment.

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