

Water Quality Assessment of Ground Water of Jaipur

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E-mail: pmisradr@gmail.com**Abstract**

The present study is related to the assessment of groundwater quality standards for Jaipur, Rajasthan. Ground water samples were collected and a complete chemical biochemical analysis was conducted. In this study, 40 water samples were taken from 10 different regions of Jaipur. Quality parameters were taken into account: temperature, pH, total hardness, dissolved oxygen, phosphate, chloride, fluoride, sulfur, alkalinity, Calcium, Magnesium, Cadmium, Lead and Electrophoresis. The analysis shows that groundwater in Jaipur province requires some treatment before being used as drinking water and measures must be taken to protect groundwater from additional pollution.

Keywords: Jaipur City, Ground water quality, Physico-chemical parameters

Introduction

Water is the main component and fluid for most living organisms. It is important for all known life forms, although they do not provide calories or organic nutrients. Water is the most magnificent complex in nature and abundant and useful, it is the basis of all living things and plants in our land. A basic need for all lives. It is also important for agriculture, forestry, livestock, agriculture, fishing, trade or industry. Water quality is more important than its quantity, especially for drinking, its purity is more important. The physical and microbiological characteristics of groundwater are useful in providing municipal, commercial, industrial, agricultural and domestic water. Jaipur is one of the fastest growing cities in the country, with Jaipur witnessing urbanization and rapid industrialization. Urbanization has put enormous pressure on the quality and quantity of groundwater.

Materials and Methods

1. Site Selection: Samples are collected from the following sites :

Site –I : Kumbhawas

Site –II : Nawalpura,

Site –III : Kant Kalwar -RIICO Industrial Area ,

Site –IV : Achrol ,

Site –V : Kukas- RIICO Industrial Area ,

Site –VI :Badi chaupar ,

Site –VII :Jawahar Nagar ,

Site –VIII :Malviya Nagar RIICO Industrial Area ,

Site –IX :Gandhi Nagar ,

Site –X :Sitapura - RIICO Industrial Area .

2. Sample Collection

The water sampling was done from August 2018 to September 2018 in between 9.00 a.m to 2.00 for physicochemical parameters namely Temperature ,pH, Total hardness, Dissolved oxygen, Phosphate, Chloride, Fluoride, Sulphate, Alkalinity, Total dissolved solids, Calcium, Magnesium, Cadmium , Lead and Electricalconductivity were analysed.

3. Physicochemical Analysis of Water:

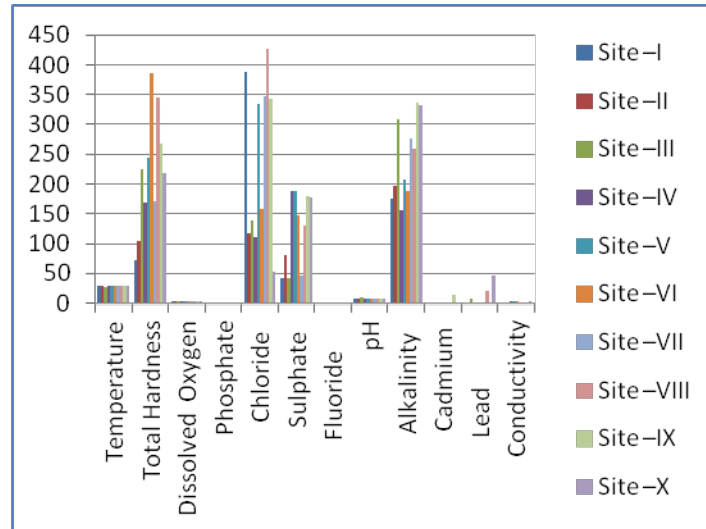
- i. Temperature : Temperature of the samples taken by thermometer .
- ii. pH: pH was determined using the standard pH meter. The pH electrode was dipped in the solution and pH was recorded after every 4 days.
- iii. Total Hardness: The total hardness of the water samples was determined by the EDTA calibration method. 50 mL of the well mixed sample was mixed with 1-2 ml of buffer pH 10 and a small T-Eriochrome black index. The contents were calibrated with 0.01 M EDTA until the red wine solution was changed to blue.
$$\text{Hardness (mg/L)} = C \times D \times 1000 / \text{ml of Sample}$$

Where C = ml of EDTA for titration
D= mg of CaCO₃ equivalent to 1ml of EDTA
- iv. Dissolved Oxygen (DO): Dissolved oxygen content of the water samples was measured by using Winkler's method (modified azide method). The sample was collected in 300 ml bottle and DO was fixed on site by using 1 ml each of Manganous sulphate and Alkaline-iodide-azide. The precipitate formed was dissolved in laboratory by using sulphuric acid and titrated with sodium thiosulphate using starch as an indicator. The end point of titration was blue to straw pale colour.
$$\text{DO (mg/L)} = \text{ml of titrant} \times N \times 1000 \times 8 / V_2(V_1 - V_2) / V_1$$
- v. Determination of Sulphate, Phosphate and Fluoride: The concentration of Sulphate, Phosphate and Fluoride ions in the samples were determined by UV-Visible spectrophotometer using standard solutions.
- vi. Chlorides: Chloride content was measured by Mohr calibration method. 50 ml of the sample (V) was diluted to 100 ml in a colored sample. 3 ml of aluminum hydroxide was added, mixed well and allowed to settle after being filtered and washed. The filter was collected, pH was then adjusted to 7-8 acid / alkaline , 1 mL of potassium chromate was added and calibrated against the standard silver nitrate solution until a reddish brown deposit was obtained. The end point was observed as (V1). The procedure is repeated for the blank and the endpoint is marked as (V2).
$$\text{Chloride in mg/l} = (V_1 - V_2) \times N \times 35.6 \times 1000 / V$$
- vii. Alkaline Determination: Alkalinity in water due to the presence of weak acids such as hydroxides, carbonates, potassium bicarbonate, sodium, magnesium, calcium and some heavy metals. Alkalinity was determined from all groundwater samples by simple calibration of sulfuric acid (H₂SO₄) in the presence of methyl-orange and phenolphthalein indicators.
- viii. Total Dissolved Solids (TDS) was also determined by estimated by Gravimetric method.
- ix. Determination of Lead (Pb) and Cadmium (Cd) metal ions: The samples were digested using 2% HNO₃ and then analyzed by Atomic Absorption Spectrometer (Perkin-Elmer-Aanalyst- 100, Germany) for lead and cadmium metals on air-acetylene flame at wavelengths 283.2 nm and 228.8 nm, respectively.

Result and Analysis

The Analysis of water samples collected were done for estimation of physiochemical parameters Twelve parameters are determined i. Temperature ,pH, Total hardness, Dissolved oxygen, Phosphate, Chloride, Fluoride, Sulphate, Alkalinity, Total dissolved solids, Calcium, Magnesium, Cadmium , Lead and Electricalconductivity.

Figure-1 :Overall Analytical Parameters Representation

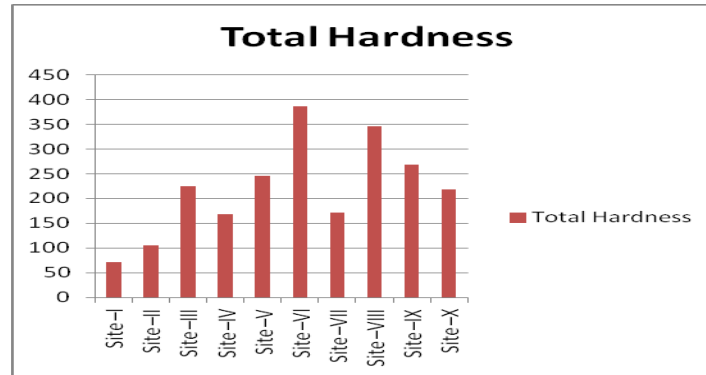


Groundwater samples were collected from selected sites in Jaipur, Rajasthan. The physiochemical parameters analyzed for the samples shown in Table 1 showed that the total hardness in the water samples was found in the range between 72 ppm and 386 ppm. All hardness values are observed in all Jaipur samples within the limits permitted by the Indian Standards Office (BIS) (limit: 200 ppm and 600 ppm). Five sites to know. Kakas, RIICO (245 ppm), Badi Chopar (386 ppm), Malviya Nagar (346 ppm), Gandhi Nagar (268 ppm) and Sitapura RIICO Industrial Area (218 ppm) The levels are slightly higher than the standard (desired limit) but these values can be safe to drink, which can be extended to 600 ppm specified in Indian standards.

Table :-1 Total Hardness and Dissolved Solids Parameters

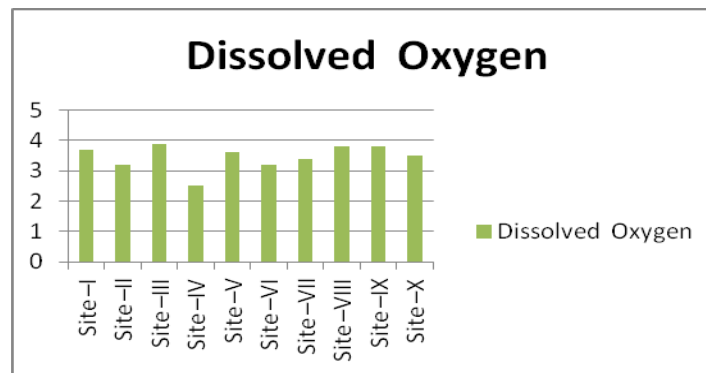
S.N.	Sampling Site	Temperature	Total Hardness	Dissolved Oxygen
1	Site –I	29	72	3.7
2	Site –II	29.5	105	3.2
3	Site –III	28	225	3.9
4	Site –IV	28.5	168	2.5
5	Site –V	29.2	245	3.6
6	Site –VI	28.9	386	3.2
7	Site –VII	28.8	172	3.4
8	Site –VIII	28.8	346	3.8
9	Site –IX	29.2	268	3.8
10	Site –X	29.4	218	3.5

Figure 2– Representation of Total Hardness



Dissolved oxygen (DO) produces energy for growth and reproduction. The maximum practical cleaning according to BIS / WHO is 6 mg / L 18. The analysis shows DO levels in all samples, while the lowest (2.5 mg / L) was found in samples collected from acrol, while maximum 3.8 mg / L) in samples collected from the region. Industrial Malvia Carpenter Ricoh and Gandhi Nagar.

Figure 3– Representation of Dissolved Oxygen



The phosphate concentration found any sample of water collected from different locations in Jaipur.

Analysis shows chlorine levels in several samples. The minimum concentration (52.3 mg / L) was found in the industrial area of Sitapura RIICO and maximum (426.3 mg / L) in the industrial area of Malviya Nagar RIICO. The chloride level was found within the permissible limits (1000 mg / L) but in five samples higher than the required limit (250 mg / L) was found. 17. High concentration of chlorine can lead to salty taste and high blood pressure.

Figure 4– Representation of Chloride

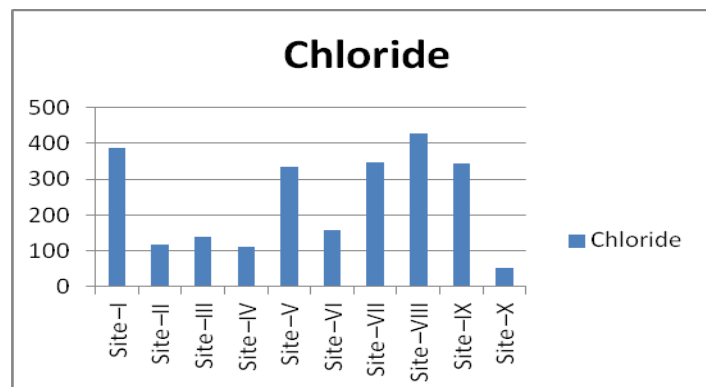
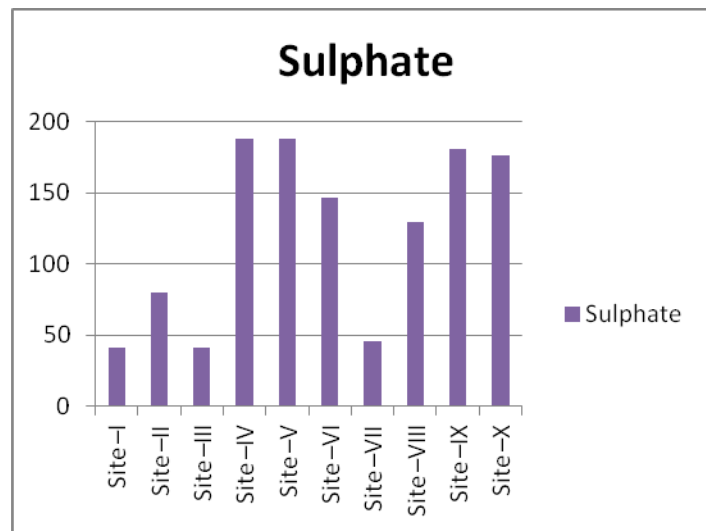


Table -2 Phosphate,Chloride,Sulphate & Floride Parameters

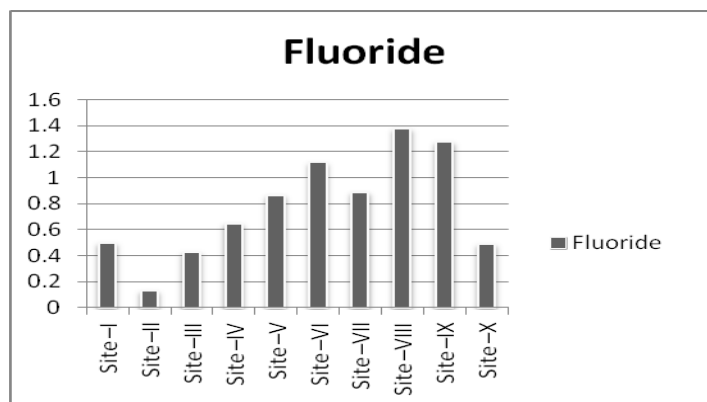
S.N.	Sampling Site	Phosphate	Chloride	Sulphate	Fluoride
1	Site –I	0	387	41.5	0.5
2	Site –II	0	116.8	79.9	0.13
3	Site –III	0	137.8	41.5	0.43
4	Site –IV	0	109.9	188.2	0.65
5	Site –V	0	334.5	187.7	0.87
6	Site –VI	0	158.9	146.9	1.12
7	Site –VII	0	346.7	45.73	0.89
8	Site –VIII	0	426.3	129.6	1.38
9	Site –IX	0	342.5	180.4	1.28
10	Site –X	0	52.3	176.7	0.49

The concentration of sulphate for many groundwater samples shows that the lowest level (41.5 mg / L) was found in the water samples collected from Compahuas and Kant Kalwar, the industrial zone of Rico, while the maximum level (187.7 mg / L) obtained from samples Of the Kukas RIICO industrial area in Jaipur, but values were found for all samples within the desired limits (200 mg / L) and the permissible limit (400 mg / kg).

Figure 5– Representation of Sulphate

Fluoride level in water samples from selected areas and the concentrations have been found in the range between 0.13 mg/l and 1.38mg/l. Most of the samples contained slightly lower fluoride level than desired limit (1.0 mg/l) while water samples collected from Badi Chaupar (1.12 mg/l), Malviya Nagar RIICO Industrial Area (1.38 mg/l) and Gandhi Nagar (1.28 mg/l) have slightly higher than desirable limit but less than permissible limit (1.5 mg/l). Increasing fluoride concentration can cause the brownish discoloration of teeth and bone damage.

Figure 6– Representation of Fluoride



Results 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 desired limit is upto 6.5-8.5 according to BIS.

Figure 7– Representation of Sulphate

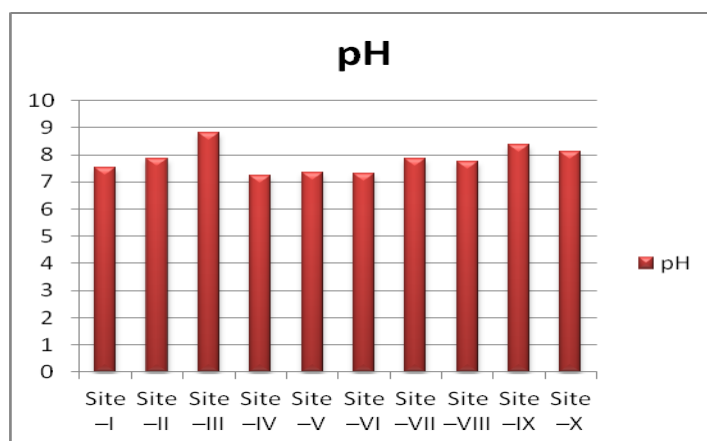
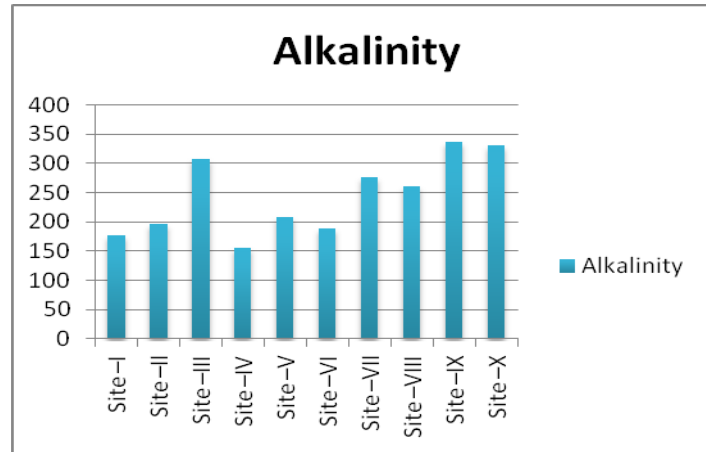


Table -3 pH,Alkalinity,Cadmium and Lead Parameters

S.N.	Sampling Site	pH	Alkalinity	Cadmium	Lead
1	Site –I	0	387	41.5	0.5
2	Site –II	0	116.8	79.9	0.13
3	Site –III	0	137.8	41.5	0.43
4	Site –IV	0	109.9	188.2	0.65
5	Site –V	0	334.5	187.7	0.87
6	Site –VI	0	158.9	146.9	1.12
7	Site –VII	0	346.7	45.73	0.89
8	Site –VIII	0	426.3	129.6	1.38
9	Site –IX	0	342.5	180.4	1.28
10	Site –X	0	52.3	176.7	0.49

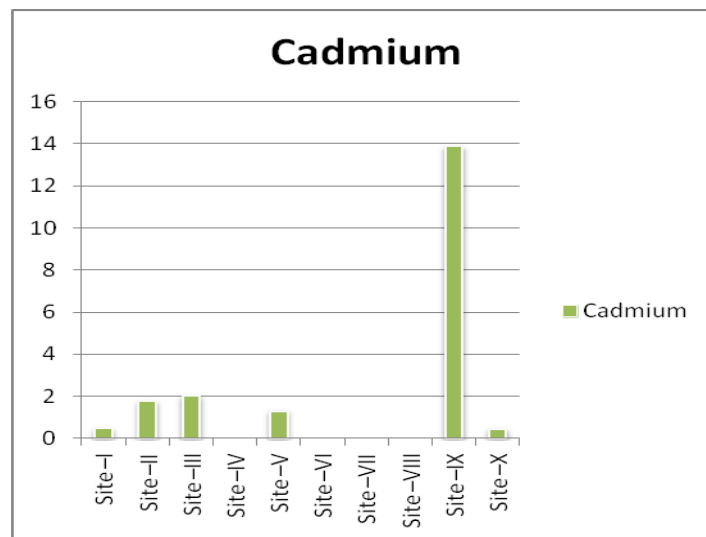
Alkaline concentrations in all collected samples show that the minimum alkaline value was observed at 156 mg / l acrole, while the maximum value is 336 mg / L in Gandhi Nagar. The alkaline limit according to Indian standards is 200 mg / l 19. The alkaline level is found above the desired boundary of Kukas, the industrial zone in RIICO (208 mg / L), the Malviya Nagar industrial zone in RIICO (260 mg / l), and Jawahar Nagar (276 mg / l), Kant Kalwar, RIICO (308 mg / l), Sitapura (336 mg / l) and Sitapura RIICO Industrial area (332 mg / l) sites, but less than the allowed limit / l). Low alkaline means. High acidity leads to corrosion in pipes and increases the possibility of disintegration of many heavy metals found in water in pipes, welds or plumbing fittings.

Figure 8– Representation of Alkalinity



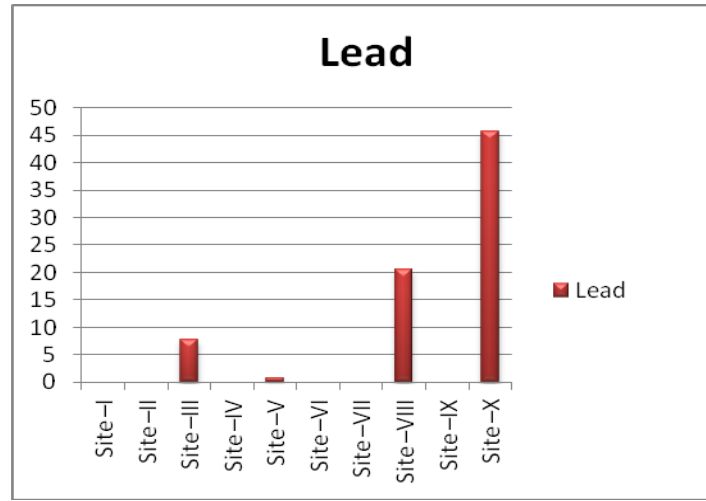
The cadmium concentration have been found in the water samples collected from Kumbhawas, Nawalpura, Kant Kalwar -RIICO Industrial Area, Kukas - RIICO Industrial Area, Gandhi Nagar, and Sitapura RIICO Industrial Area areas of Jaipur while samples collected from Achrol, Badi chaupar, Jawahar nagar and Malviya Nagar RIICO Industrial Area have no cadmium content. Cadmium is highly toxic and can cause 'itai-itai' disease-painful rheumatic condition, cardio vascular system related problems, gastro intestinal upsets and hypertension.

Figure 9– Representation of Cadmium



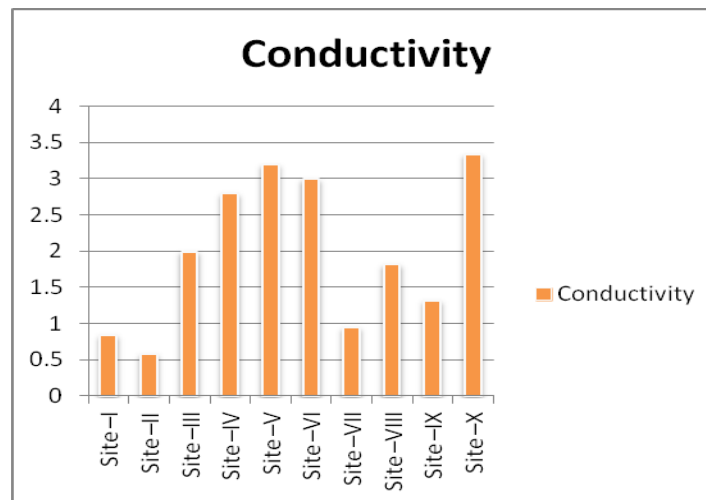
Lead content was found in samples from Kant Kalwar, RICO Industrial Zone, Kukas, RIICO Industrial Zone, Malviya Nagar, RIICO and Sitapura Industrial Area, RIICO. In all four samples, the lead level was found above the required limit (0.01 mg / L), while the lead content was not found in the samples of Compahuas, Nwalora, Azureul, Basi Chopper, Jawhar Nagar and Gandhi Nagar. When the lead service pipes are corroded, especially when the water is high acidity or low metallic content spoils the pipes. In Sitapura and Nagar Malviya, there can be a high level of lead content due to the existence of heavy industries. High lead content can cause abdominal discomfort, irritability, anemia and damage to kidneys.

Figure 10 – Representation of Lead



The electrical conductivity shows the minimum (0.58 mhos/cm) value at the site of Nawalpura,, whereas the maximum levels (3.34 mhos/cm) in the samples of Sitapura - RIICO Industrial Area.

Figure 10 – Representation of Conductivity



Conclusion

By the above mentioned analysis and observations we can conclude that the total hardness in water samples has been found in the range between 72 ppm and 386 ppm. The level of dissolved oxygen were found minimum in the sample of Achrol while maximum Dissolved Oxygen level was found in Kant Kalwar –RIICO Industrial Area . .

The minimum chloride was estimated in Sitapura -RIICO Industrial Area and maximum in the samples of Kumbhawas . The levels of chlorides have been found within the permissible limits in the samples but in five sites the results were above the desired limit. The pH level in all water samples was found slightly alkaline in nature but all the samples were safe for drinking purposes according to BIS . The level of sulphate shows minimum level in the water sample of Kumbhawas and Kant Kalwar -RIICO Industrial Area and maximum values were found in the samples of Achrol , but the values for all samples have been found within the permissible limits. The Level of fluoride shows its values within the permissible limits. The alkalinity levels are more than the permissible limits in the samples of Malviya Nagar RIICO Industrial Area ,Gandhi Nagar ,Sitapura - RIICO Industrial Area, Jawahar Nagar and Kant Kalwar -RIICO Industrial Area . Cadmium has been found in the samples Kumbhawas,Nawalpura,Kant Kalwar -RIICO Industrial Area ,Kukas- RIICO Industrial Area ,Gandhi Nagar and Sitapura - RIICO Industrial Area .Lead has been found in samples of Kant Kalwar - RIICO Industrial Area ,Kukas- RIICO Industrial Area ,Malviya Nagar RIICO Industrial Area and Sitapura - RIICO Industrial Area .of Jaipur. The minimum electrical conductivity was found in the ground water of the site of Nawalpura and the maximum electrical conductivity found in the samples collected from Sitapura - RIICO Industrial Area. No traces of phosphate were found in any sample .

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