Study of Physiochemical parameters of Ground water quality of Chaksu block(Jaipur) Rajasthan

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Ground water quality parameters of villages of Chaksu block(Jaipur) Rajasthan, have been assessed in this study. Thirty four water samples were collected from different sources of villages of Chaksu and analyzed for parameters - pH, EC total dissolved solids, total hardness, fluoride, nitrate, sulphate, biological oxygen demand, chemical oxygen demand, cadmium and lead. Finding parameters were compared with the IS water quality parameters. It was found that some of the samples under study fall in polluted zone. The results shown that Fluoride, TDS etc. parameters were more than permissible limits in study area.

Key words: Ground water, physicochemical parameters, contamination, permissible limit, polluted area.

I.INTRODUCTION

The rapid growth of urban areas has further affected the ground water quality due to over exploitation of resources and improper waste disposal. The total dissolved solids content of subsurface water is two to three times higher than that of surface water. The higher TDS may be due to longer residence time, favoring acquisition so solute through rock weathering. Hence there is always a great concern over the protection and management of ground water quality. Pollution of water is caused by organic as well as inorganic pollutants, industrial waste water, particularly from mining and metallurgical paint manufacturing and plating contains large amount of toxic and heavy metal ions which are hazardous to man as well as to marine and plant life. Some of these trace metals like Cd, Hg, Pb etc. are considered to be highly toxic, while some other metals like Zn, Ag, Fe etc. can also be considered so as at appropriate levels. Excess of fluoride concentration causes fluorosis in human being whereas it affects animal breeding and cause molted teeth of the young animals. Rajasthan is one of the most affected state with respect to fluorosis as more than 20 districts have been identified as endemic for fluorosis.Water Pollution is a matter of great concern for environmentalists all over the world. As a result of increased industrial activity in our country during the post-independence period i.e. from the year 1947, India is today rated as one among the first ten industrial countries of the world.

Environmental degradation has become a global phenomenon as rapid industrialization and urbanization has resulted many fold increase in pollution. Every town and city of developing countries is facing the challenges of environmental pollution with the persistent efforts being made by man to utilize the natural resources for improving the living standard and for providing extra comforts, the magnitude of pollution is increasing day by day.

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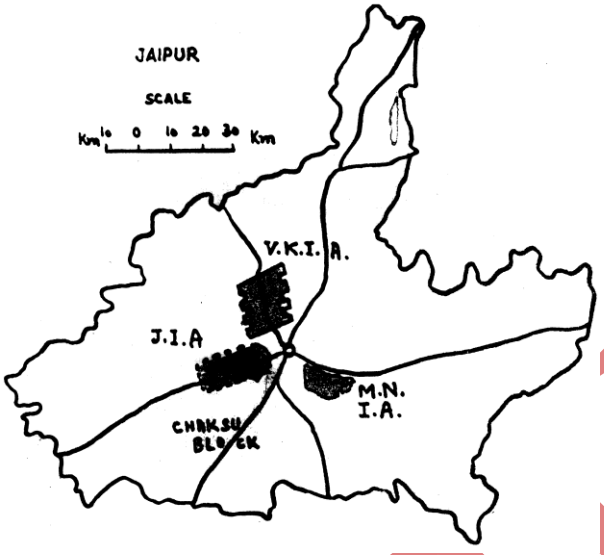

Figure :**Sudy area Chaksu block**

About 80% of India's inland water is unfit for human consumption and major cause of deterioration of water quality is the discharge of industrial waste in to water sources. Most of industries do not have any treatment plant so they discharge their effluents in to water sources without any treatment. Such polluted water influences the aquatic and terrestrial biota and their community structure. Among the various toxic substances present in polluted water the effect of metal ions are extremely severe.

Presence of potentially hazardous heavy metals in water should be considered abnormal and this usually affects its appearance and palatability. Fresh water ecosystems are influenced by air, heavy metal levels and addition from anthropogenic sources. The chemical forms of these metals in water are accessible to the biota through significant accumulation in the food chain. Toxicity of metals depends on their concentration, if concentration of metals is high, toxicity becomes greater in the environment and affect the quality of water.Waste water from dyeing industry is highly coloured due to presence of dyes used. Due to its highly polluting nature it is not possible to discharge if untreated. Because this waste water causes ground water pollution therefore it is a desirable to remove chemicals present in it, before discharging. The quality of water is usually described by its physico-chemical and micro-biological characteristics. Drinking is one of the main routes of intake of heavy metals in the human body. It has therefore, drawn special attention of health management people.

This paper highlights the various physico-chemical parameters of ground water from various villages of Chaksu block, which will helps us to formulate the strategy for mitigating the harmful effects of ions present above the prescribed levels.(Table 1)**.**

Therefore, determination of ground water quality is important to observe the suitability of water for a particular area.

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Table 1

DRINKING WATER STANDARES (IS : 10500-1991)

S. No.	***Parameters***	***Desirable limit mg/l***	***Permissible limit in the absence of alternate source***
1.	*Colour (Hazen Units)*	*5*	*25*
2.	*Odour*	*Unobjectionable*	*-*
3.	*Taste*	*Agreeable*	*-*
4.	*Turbidity, NT Units*	*5*	*10*
5.	*pH*	*6.5-8.5*	*No relaxation*
6.	*Total Hardness as $CaCO_3$*	*300*	*600*
7.	*Iron as Fe*	*0.3*	*1.0*
8.	*Chloride as Cl*	*250*	*1000*
9.	*Free residual chloride*	*0.2*	*-*
10.	*Total Dissolved solids*	*500*	*2000*
11.	*Calcium as Ca*	*75*	*200*
12.	*Copper as Cu*	*0.05*	*1.5*
13.	*Manganese as Mn*	*0.1*	*0.3*
14.	*Sulphate as SO_4*	*200*	*400*
15.	*Nitrate as NO_3*	*45*	*100*
16.	*Fluoride as F*	*1.0*	*1.5*
17.	*Phenols as C_6H_5OH*	*0.001*	*0.002*
18.	*Mercury as Hg*	*0.001*	*No relaxation*
19.	*Cadmium as Cd*	*0.01*	*No relaxation*
20.	*Selenium as Se*	*0.01*	*No relaxation*
21.	*Arsenic as As*	*0.05*	*No relaxation*
22.	*Cyanide as CN*	*0.05*	*No relaxation*
23.	*Lead as Pb*	*0.05*	*No relaxation*
24.	*Zinc as Zn*	*5*	*15*

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25.	*Anionic detergnets as MBAS*	*0.02*	*1.0*
26.	*Chromium as Cr*	*0.05̃*	*No relaxation*
27.	*Mineral Oil*	*0.01*	*0.03*
28.	*Pesticides*	*Nil*	*0.001*
30.	*Alkalinity as $CaCO_3$*	*200*	*600*
31.	*Aluminium as Al*	*0.03*	*0.2*

II.EXERIMENTAL

The water samples collected form the study areas(Chaksu Block) were subjected to various chemical analysis methods, manually and instrumentally. pH and conductivity of water samples were measured by using a pH meter and a conductivity bridge or microprocessor water & soil analysis kit model 1160E respectively. The parameters like TDS, chloride, sulphate etc. were estimated by conventional manual methods. Spectrometric methods were used to determine the concentrations of Nitrate and fluoride. Parameter COD was measured by instrumental methods. The major cations such as sodium and potassium were estimated by flame photometer. Calcium and Magnesium were determined by complexometric titration with EDTA.

Collection of ground water samples

The ground water samples were collected in pre-cleaned one-liter plastic bottles from borewells, handpumps and openwellsfrom Chaksu block.. Bottles were cleaned with hydrochloric acid then washed with tap water and then rinsed with distilled water twice and again rinsed with the water sample to be collected and field up one-liter bottles with the water samples. Some samples which were turbid or containing suspended matter were filtered at the time of collection with membrane filter of porosity 0.45m/u.

Analysis of ground water samples

The physicochemical parameters pH, EC,Total Hardness (TH), Total Dissolved Solids (TDS),Ca, Mg, COD, , Chloride (Cl^-), Nitrate (NO_3^-), Sulphate (SO_4^{-2}), Fluoride (F^-), Sodium , Potassium were determined using standard Methods. Specific reagents were used for the analysis and double distilled water was used for preparation of solutions. Results are shown in the Table 2.

TABLE –2

CHEMICAL ANALYSIS OF GROUND WATER SAMPLES OF CHAKSU BLOCK IN JAIPUR DISTRICT

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Sam. No.	pH	Conductivity □s/cm	TDS mg/l	Total Hardness mg/l	Ca Hardness mg/l	Mg Hardness mg/l	C.O.D. mg/l	Cl^- mg/l	F^- mg/l	Na^+ mg/l	K^+ mg/l	SO_4^{2-} mg/l	NO_3^- mg/l
1.	8.5	2715	1575	205	28	42	3.50	142	4.5	556	Tr.	165	8
2.	8.7	4150	2450	220	18	22	3.10	260	5.0	940	1.0	156	10
3.	8.5	4650	2615	315	74	65	4.00	256	3.5	850	1.1	44	12
4.	8.6	1275	760	230	22	27	2.65	229	3.2	245	0.9	48	58
5.	8.3	815	560	130	15	36	2.65	595	1.2	150	Tr.	120	35
6.	8.5	7560	4350	450	44	48	4.05	1020	5.6	1605	Tr.	185	22
7.	9.1	5720	3250	150	32	85	9.30	65	1.2	1125	0.3	18	30
8.	8.8	4815	2420	185	26	65	8.8	112	4.5	825	0.5	27	58
9.	9.1	6250	3970	290	44	38	10.60	1850	5.3	1205	Tr.	305	45
10.	8.8	3850	2260	425	16	65	1.92	1150	2.4	835	Tr.	340	25
11.	8.4	1775	1105	328	35	105	4.50	920	4.1	295	1.0	195	40
12.	8.3	4150	2250	442	55	120	1.40	1650	1.2	650	1.1	185	15
13.	8.8	7250	4050	185	56	32	2.2	650	2.2	1305	Tr.	145	32
14.	8.5	1075	750	356	16	95	1.80	375	3.0	308	Tr.	95	20
15.	8.4	3315	1990	556	40	35	0.45	875	2.2	720	0.4	175	102
16.	8.5	3750	1675	620	28	45	4.4	1815	3.0	564	0.2	265	95
17.	8.7	1595	985	230	15	65	5.80	280	3.5	305	Tr.	78	28
18.	8.6	1615	975	536	22	42	4.18	890	3.6	145	Tr.	92	72
19.	8.7	1875	1305	365	42	65	1.50	485	1.7	352	1.0	220	22
20.	8.2	6880	4150	890	76	170	4.50	1520	2.8	1175	Tr.	265	655
21.	8.9	725	375	175	45	15	6.00	70	1.7	.82	1.0	25	38
22.	8.7	1305	875	315	92	16	7.8	78	4.3	305	Tr.	128	62
23.	8.8	2150	1265	550	95	52	9.0	340	3.1	365	1.0	122	118
24.	9.0	5200	2950	275	18	50	6.5	775	3.2	1005	Tr.	572	65

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25.	*8.9*	*4750*	*2560*	*415*	*35*	*82*	*4.5*	*720*	*3.1*	*785*	*Tr.*	*442*	*38*
26.	*9.0*	*1905*	*2450*	*412*	*30*	*79*	*0.65*	*720*	*3.2*	*615*	*1.0*	*192*	*62*
27.	*8.8*	*6815*	*1645*	*102*	*13*	*15*	*1.50*	*215*	*2.0*	*385*	*Tr.*	*82*	*44*
28.	*9.0*	*1290*	*2670*	*635*	*74*	*109*	*5.5*	*715*	*3.0*	*735*	*1.0*	*775*	*20*
29.	*9.0*	*2050*	*1765*	*75*	*21*	*7*	*8.5*	*512*	*2.2*	*565*	*1.0*	*310*	*22*
30.	*8.9*	*5200*	*1690*	*240*	*15*	*44*	*4.0*	*345*	*4.1*	*570*	*Tr.*	*255*	*108*
31.	*9.0*	*4750*	*865*	*505*	*40*	*102*	*3.5*	*365*	*0.9*	*192*	*Tr.*	*95*	*25*
32.	*9.2*	*2925*	*715*	*275*	*13*	*58*	*1.5*	*102*	*2.5*	*190*	*1.0*	*58*	*44*
33.	*7.60*	*2250*	*845*	*205*	*14*	*40*	*0.6*	*165*	*1.7*	*272*	*1.0*	*70*	*10*
34.	*8.60*	*7600*	*890*	*540*	*36*	*107*	*7.8*	*240*	*2.1*	*70*	*Tr.*	*65*	*32*

III.RESULTS AND DISCUSSION

Thirty four ground water samples from various villages of Chaksu block were collected for chemical analysis of water and their results are presented in Table- 2

pH :

pH is a measure of the intensity of acidity or alkalinity and the concentration of hydrogen ion in water. pH value below 4 produces sour taste and a higher value above 8.5 give alkaline taste. In the present study, the pH values of water samples varied between 8.3to 9.1 (Table 2) , which is permissible limits as compare to IS(Table 1).

Determination of pHis one of the important objectives for the treatment of waste. Significant changes in pHoccur due to the disposal of industrial waste and acid mine drainage.

Electric Conductivity (EC) :

Electrical conductivity is a numerical expression of the ability of an aqueous solution to carry the electric current which depends on the presence of ions, their total concentration, mobility and temperature. In present study, the lowest value of Electrical Conductivity was recorded as minimum 725us/cm and highest value 7600 us/cm. Significance of conductivity measurements is essential to indicate concentration of ionizable substances dissolved in water.

Total dissolved solids (TDS)

Water containing more than 500 mg/l of TDS is considered desirable for drinking. In present study, the TDS value varies from 560 to 4350 mg/l in the ground water samples. It was noticed that approximately all water sample have more TDS as compare to IS permissible limits.

Total hardness (TH) :

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Hardness in water is due to the natural accumulation of salts from contact with soil and geological formations or it may enter from direct pollution by industrial effluents. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. In the present study, total hardness varied from 130 mg/L to 890 mg/L , So 15% samples showed higher values than permissible limit of drinking wateras compare to IS(Table 1).

Chloride (Cl^-) :

The most important source of chlorides in the wateris the discharge of industries sewage. The chloride value in the study area varies from 65 to1850mg/l. A limit of 250 mg/l chloride has been recommended as desirable limit and 1000mg/l as maximum permissible limit for drinking water (Table 1).The chloride values in twenty eight samples are within permissible limit. Only six ground water samples have more chloride concentrations as compare to IS permissible limits (table 1).

Fluoride (F^-) :

The fluoride concentration in the study area varies from 0.9 to 5.6 mg/l. About 88% sample crossed the permissible limit of 1.5mg/l. If the fluoride in drinking water is less than 0.5mg/l, the incidence of dental disease in children is likely to be high. However, when present in much greater quantities they can cause endemic cumulative fluorosis resulting skeletal damage. Result showed that ground water sample of mostlyvillages contain more fluoride concentrations then permissible limit.

Nitrate (NO_3^-) :

The nitrate value in the study area varies from 8 to 102mg/l. Increased level of nitrate at various locations may be attributed due to the surface disposal of sewage and agricultural wastes. Nitrate is effective plant nutrient and moderately toxic and is considered important for drinking water supplies. Result showed that ground water sample of mostly villages contain **Nitrate** concentrations within permissible limit (45 to 102mg/l).

Sulphate (SO_4^{-2}) :

The Sulphate value in the study area varies from 18 to 775mg/l.High amount of sulphate cause laxative effect to the children in hot weather climates. In the all sample of studied area, sulphate concentration in drinking water is below the standard.

In most natural waters, sulphate is found in smaller concentration than chloride. Sulphate may also result from the oxidation of the reduced forms of sulphur such as sulphide and sulphite, or forms the waste of various industries. Many sulphates are readily soluble in water and once dissociated, the sulphate ion is relatively stable. Sulphate may be very high in some well waters and in surface water in arid regions where sulphate minerals are present.Only four ground water samples have moreSulphate concentrations as compare to IS permissible limits (Table 1).

Calcium :

Calcium content was recorded in the range between 13 mg/l to 95 mg/l. The excessive use of chemical which are rich in calcium salt increase the concentration ion of calcium in vegetable oil and chemical & drug effluents. Result showed that ground water sample of mostly villages contain calcium contentswithin permissible limit

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Magnesium ;

The magnesium value in the study area varies from 7 to 170mg/l. Increased level of magnesium at various locations may be attributed due to the surface disposal of sewage and agricultural wastes. In the all sample of studied area, magnesium containsin drinking water are below the standard.

Chemical Oxygen Demand (COD) :

Chemical oxygen demand is a measure of materials present in water that may be readily oxidized. The value obtained is helpful in ascertaining the amount of organic and reducing material present in streams or industrial wastes. During research work, the COD values were found in between 0.45 mg/l to 10.60 mg/l (Table-2). According to drinking water guidelines fixed by Bureau of Indian standards, COD value should not be more than 10 mg/l.Onlytwo ground water samples have moreCOD concentrations as compare to IS permissible limits (Table 1).

Sodium :

Sodium is most important and abundant of the alkali metals in natural water. The principal source of sodium in water is the evaporate sediments although sewage, industrial wastes and oil-field drainage also contribute in significant amounts. In saline and brackish water its concentration is remarkably high and limits the biological diversity due to osmotic stress.

Potassium :

Potassium is normally present in water in smaller amounts than sodium. Concentration of potassium in most natural waters are generally less than 10 ppm and commonly ranges between 1.0 ppm to 5.0 ppm. Although potassium is an essential element for both animals and plants life. Traces of this element are desirable for plant life, but excessive concentrations may be harmful and it is recognized that this constituent should be balanced with other mineral requirements.

IV.CONCLUSION & SUGGESTIONS

The average value of conductance in the residential area is within the limit or slightly higher which is not too harmful but the value in the industrial area is high and in few it is quite high. The conductance depends on the concentration of ionised mineral salts in the water sample, the water in the zone is not suitable for irrigation, drinking and other purposes.

The excessive use of chemicals which are rich in calcium and magnesium salts increases the concentrations of these elements in effluents from marble & textile industries. Due to these reasons metal ions were also analysed in the effluents of these industries and it was found that concentration of metal ions in effluents depend on the raw material used and the processes involved in the industries.At few places due to higher concentration of fluoride in ground water in Chasku block in Jaipur district (Table-2). Mottling of teeth, skeletal fluorosis, deformation in knee joints and other parts of the body occurs in the persons who live in this area. However, a small amount of fluoride is important in human nutrition for the normal development of boner.

So, our investigations are useful for government authorities, for taking care and reducing ground water pollution.

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V.ACKNOWLEDGEMENT

The authors thank to Head, Shri G.K Sharma for providing laboratory facilities in the institution. Authors are also thanks to shriNeelabhpandit, Dr.R.N.Yadav,Dr. Rajesh Yadav, Dr. O.P. Singh, Dr. Upendrasingh, Sh.G.L.Meena (Govt. college, Rajgarh) for language correction and Dr. M P S Chandrawat, Dean, School of ChemSci and Tech, Eternal University, Sirmour (HP) for his keen guidance in preparing the manuscript and also thankful to Jay SinghGautamand MohanLalSharma.

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