

Drinking Water Quality of Rajasthan Districts

Shashank Saurabh¹, Dharampal Singh², Sameer Tiwari³

^{1,2}Central University of Rajasthan

³WIHG

Abstract: A systematic and well planned study carried out to make assess the water quality of Rajasthan districts. In this study it is found that water parameters are very much varied from their permissible limit. Mainly physico-chemical parameters like pH, TDS, Conductivity, alkalinity, salinity, hardness, calcium, magnesium, chromium, sulphate, iron, sodium, potassium, nitrate, fluoride studied. Results of these parameters are very much varying among themselves. Such as if we talk about pH then we found that its value were from 3.05, 5.41, 8.52 in places like churu, Alwar and Jodhpur etc which shows extent of variation of parameter . Not only in case of pH while in case of other parameters like nitrate, fluoride values reach upto 147 and 5.12 in main districts like Jaipur and Jhunjhunu. Districts which were selected for sampling are Jaipur, Ajmer, Jhunjhunu, Sikar, Jodhpur, Bharatpur, Alwar, Pali and karauli. Railway station and bus stand were selected as two sampling point from all districts. Maximum and minimum range of values for parameters like pH TDS, Conductivity, Hardness etc are as follows :pH-[8.52 and 3.05], TDS-[3240 and 186] Hardness –[1100 and 70] etc. and so on. So from over all detail study it has been concluded that Rajasthan districts which covered for study are affected directly by these parameters. We understand this all in a better way because Rajasthan capital [Jaipur] is also in category of effect.

Keywords: Physico-chemical parameters, Railway station, Bus stand

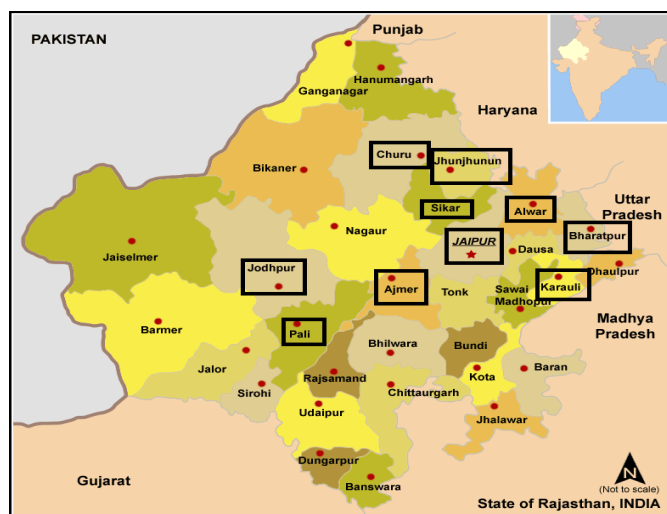


Fig. 1.

1. INTRODUCTION

Pollutionem which is a Latin word is derivative of pollution. Pollution can be defined as “when an addition of organic inorganic or foreign material take place because of any reason, physical change start to develop in environment which adversely affect living organism direct or indirect termed as pollution”. Water is an important and necessary for life to exist. Physicochemical quality of water adversely affected by many reason.one of the reason is that when industrial sewage and municipal waste gets added to water. So it is necessary to examine the water of that area. For analysis purpose Rajasthan state selected in which district like Jaipur, Ajmer, Pali, Jodhpur, churu, Jhunjhunu, Alwar, Bharatpur, karauli, Sikar covered by me. From these districts two points selected for sampling. One point was Railway station and other was bus stand. The purpose for selecting railway station and bus stand was that many people used it as source to quench their thirst. Result obtained shows that the parameters which are tested by me having variation among themselves. Testing is performed by use of titration, Spectrophotometer, water-analyser kit, flame Photometer, ion-selective method. For meeting health requirement it is necessary that parameter should be in desirable limit, but after analysis it is obtained that parameters are not in permissible range.

2. MATERIAL AND METHOD

2.1 Study area

Main districts of Rajasthan were selected for sampling. Name of the districts where sampling done are following: Jaipur, Ajmer, Churu, Alwar, Jodhpur, Pali, Bharatpur, Jhunjhunu, sikar, karauli In fig.1 sampling areas are marked. In districts like Jhunjhunu and karauli railway stations are under construction. Along all district [Hindaun] a village also covered for accurate calculation in karauli district.

2.2 Sample collection and Location

Sample collection was done in that area which were close to my institute. First sampling was performed in Ajmer which was approximately 30 to 35 km form my institute after that Jaipur was selected which was around 120 km from Ajmer

and 95 km from my institute. After that Sikar, Jhunjhunu, Alwar selected as next sampling points. To avoid contamination from dust, bottles were tightly packed so no entry of contaminant to bottle take place.

2.3 Laboratory method

There are many methods to test parameters but the method which was used by me in laboratory as follows: pH-preparation of buffer solution of pH 7 and 9 to calibrate the instrument. For TDS analysis KCL solution used to calibrate the instrument. While for salinity, alkalinity, hardness titration method used while the parameters for which machine like spectrophotometer and flame photometer used were chromium, ferrous, sulphate, sodium, potassium. But in case of fluoride and nitrate determination ion selective electrode instrument bring in use.

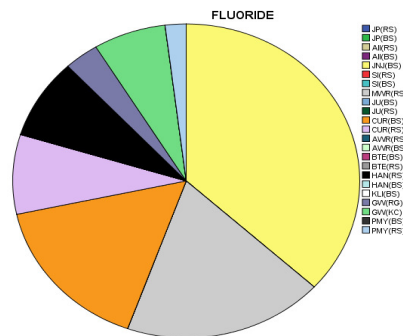
3. RESULTS

The maximum minimum and average values of parameters are given below in table 1:

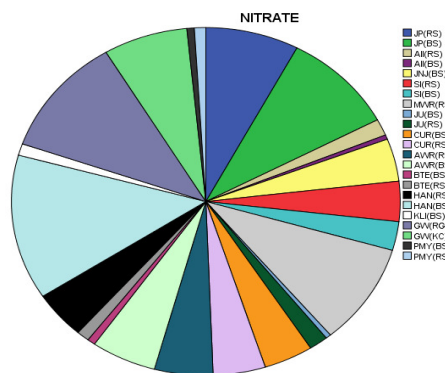
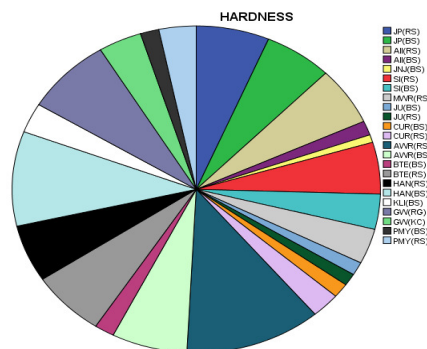
Table 1

Parameters	Max.	Min.	Avg.
pH	8.52	3.05	6.87
TDS(ppm)	3240	186	1286
Salinity(mg/l)	781	71	364
Alkalinity(mg/l)	580	20	196
Hardness(mg/l)	1100	70	400
Calcium(mg/l)	440	28	160
Mg(mg/l)	993	63	360
Cr(mg/l)	0.15	0.132	0.13
Iron(ppm)	0.34	0.22	0.24
Nitrate(ppm)	255	7.86	82.3
Fluoride(ppm)	5.12	0	0.61
Sulphate(ppm)	1.147	0.38	0.58
Sodium(ppm)	9.3	0.58	4.13
Potassium(ppm)	19.2	0.67	4.18

Above parameters maximum minimum and average values are given in which many parameters are beyond the permissible limit. The parameters which are exceeding are pH, TDS, Nitrate, fluoride, Hardness, Calcium, Magnesium, Salinity, Alkalinity etc. Graph which is given below shows the presence of excessive fluoride in Jhunjhunu (yellow colour) after that Marwar and Churu comes. Whereas in case of Bharatpur and Alwar it is zero.



Note: [1.JP=Jaipur
2. AII=Ajmer 11.KLI=karauli
3. JNJ=Jhunjhunu 12. GW=Groundwater
4. SII=Sikar 13. .PMY= Pali
5. MWR=Marwar 14. RG=Rameshwargoyal
6. JU=Jodhpur 15. .KC=kailashchandra
7. CUR=Churu 16. RS=Railwaystation
8. AWR=Alwar 17.BS= Bus stand]
9. BTE=Bharatpur
10. HAN=Hindaun



The graph which is given above shows that nitrate is present in excess amount in Jaipur [shown by code JP (RS) and JP (BS)] while Hindaun village also comes in category [shown by code HAN (RS) and (BS)]. In next case of hardness it is excess in Alwar [shown by code AWR (RS)].

Table 3.

parameters	JP(RS)	JP (BS)	All (RS)	All (BS)	JNJ(BS)	SI(RS)	SI(BS)	MWR(RS)	JU(BS)	JU(RS)	CUR(BS)	PALI(BS)
pH	7.23	7.38	7.25	7.75	8.13	7.5	5.45	7.5	8.52	8.07	6.42	6.04
TDS(ppm)	1120	910	530	407	850	1660	1260	2730	186	321	1460	342
salinity(mg/l)	426	355	71	355	142	497	355	710	142	213	355	71
alkalinity(mg/l)	120	150	120	90	250	130	190	580	70	80	20	90
hardness(mg/l)	590	550	530	130	70	470	320	320	120	110	130	150
sulpahte(ppm)	0.5	0.506	0.506	0.512	0.451	0.512	0.41	0.5	1.006	0.68	0.461	0.5
calcium(mg/l)	237	220	212	52	28	188	128	128	48	44	52	60
Mg(mg/l)	532	496	478	117	63	424	289	289	108	99	117	135
Na(ppm)	2.8	2.2	2.3	1.03	5	5	4.7	9.3	0.58	1.66	6.8	0.96
K(ppm)	6.7	6.9	19.2	3.7	0.67	5.2	3.1	3.6	3.3	6.9	2.9	3.2
Cr(ppm)	0.144	0.145	0.135	0.137	0.142	0.15	0.14	0.132	0.133	0.135	0.137	0.135
Fe(ppm)	0.262	0.226	0.235	0.235	0.245	0.232	0.23	0.284	0.242	0.242	0.239	0.232
nitrate(ppm)	147	179	29	7.86	75	70.6	50.6	178	8.18	29.9	77.8	11.6
fluoride(ppm)	0	0	0	0	5.12	0	0	2.6	0	0	2.24	0

Table 4

Parameters	CUR(RS)	AWR(RS)	AWR(BS)	BTE(BS)	BTE(RS)	HAN(RS)	HAN(BS)	KLI(BS)	GW(RG)	GW(kC)
pH	3.05	5.41	7.2	7.94	6.2	6.48	6.2	7.35	7.34	7.46
TDS(ppm)	1730	1560	820	299	1670	2670	3240	482	2390	2280
salinity(mg/l)	568	568	284	71	710	639	781	71	497	284
alkalinity(mg/l)	190	180	190	90	190	340	230	180	400	480
hardness(mg/l)	230	1100	610	160	600	520	860	270	700	350
sulpahte(ppm)	0.444	0.508	1.147	0.38	0.468	0.529	0.568	0.461	0.842	1.038
Ca(mg/l)	92	440	244	64	240	208	345	108	281	140
Mg(mg/l)	208	993	550	144	541	469	776	244	631	316
Na(ppm)	7	3.1	2	1.7	4.7	7.6	6.8	1.96	7.3	7.6
K(ppm)	4.3	3.7	3.5	3.2	2.6	2.9	1.68	1.61	1.34	1.38
Cr(ppm)	0.149	0.138	0.138	0.139	0.138	0.138	0.139	0.142	0.139	0.142
Fe(ppm)	0.232	0.232	0.232	0.222	0.226	0.343	0.222	0.235	0.248	0.232
nitrate(ppm)	82.3	92.2	103	12.5	20	83.4	255	20.4	209	133
fluoride(ppm)	1.14	0	0	0	0	1.15	0	0	0.45	0.942

4. RESULT AND DISCUSSION

In table 3 4 and 5 Results are given district wise and there is variation between the parameters.

pH

Its value is under range in most of districts, but in districts like sikar (BS) churu (RS) and Alwar (RS) its value is 5.45, 3.05, and 5.41 which is beyond the permissible range prescribed by ISI (6.5-8.5) or WHO. We easily get understand that the water we are drinking in these districts are acidic nature and yet it cause cancer [because acidosis cause lack of cellular

oxygenation and it is one of the responsible factor of cancer as stated by Dr. Otto Warburg in 1931]. Or it can affect mucous membrane

TDS

Total dissolved solid is define as total mobile charge ions including salt mineral or metal dissolved in water. In other way we say that TDS indicate that water is contaminant or not. According to Drinking water indian specification desirable limit of TDS is 500 mg/l, but in districts like Ajmer (BS) Jodhpur (BS) and (RS), Pali (BS) karauli (BS) Bharatpur (BS) TDS level is very low which states that may be essential

minerals is lacking. There are some district where TDS is very high like as Marwar (RS) [which comes in the pali district] Hindaun (RS) and (BS). It is observed Hindaun village which comes in the karauli district is very much polluted because of do not use of deep bore.

Salinity

It is defined as total amount of solid material in gram present in one kg of sea water taken and it is expressed in parts per thousand. Most of the districts having salinity above the desirable limit [which is 250 mg/l] but in certain districts limits are below of required quantity, Name of the districts which come in the category of deficiency of salinity are Ajmer (RS) Pali (BS) Bharatpur (BS) karauli (BS) and Jodhpur (BS) and (RS). Salt is very much necessary for maintenance of proper sodium in body, about 40% of body's sodium is contained in bone it makes proper nerve conduction and maintain blood pressure in body.

Alkalinity

"Acid neutralising capacity is alkalinity". It is very much necessary in the areas where the chances of acidic nature water arise. As we know that desirable and permissible limit of alkalinity is 200 mg/l to 600 mg/l respectively. Above table we get to know that the areas which are low alkalinity are as Jodhpur, Ajmer churu and pali.

Table 5

Parameters	PMY(RS)
pH	6.14
TDS(ppm)	680
salinity(mg/l)	213
alkalinity(mg/l)	160
hardness(mg/l)	300
sulpahte(ppm)	0.515
Ca(mg/l)	120
Mg(mg/l)	271
Na(ppm)	2.9
K(ppm)	4.7
Cr(ppm)	0.133
Fe(ppm)	0.235
nitrate(ppm)	17.9
fluoride(ppm)	0.271

Hardness

Hardness is generally expressed by presence of calcium and magnesium. Polyvalent ion like strontium iron and aluminium also contribute to hardness but concentration of these ions is very low in natural water so mainly calcium and magnesium considered. Presence of excess hardness and it's absent is not

good enough from economical and health point of view. In district like Jodhpur and churu, Jhunjhunu etc. range is below of permissible limit. In hardness calcium and magnesium serve as function of bone development, maintaining blood pressure etc. but it doesn't mean that it to be present in water in excess quantity. Its excess create a problem of scaling etc.

Calcium

Calcium serve as function for treatment and prevention of low calcium level and resulting bone condition including osteoporosis rickets but it excessive create a problem of Hypercalcemia. In districts like karauli, churu, Jhunjhunu, sikar etc. calcium levels are very low. In district like Alwar (BS) calcium is quiet high from permissible range but in railway station sampling point calcium level is very much high. So for proper function of body calcium must be within permissible range.

Magnesium

Just like calcium it is necessary for body development. Its deficiency and excessive quantity create health problem. But we have to be attentive because in district like Alwar its range goes upto 9 times then permissible range.

Ferrous

Iron is necessary for maintaining haemoglobin. Its deficiency causes Anaemia. In all districts it is found that iron is not up to mark of desirable limit [which is 0.3 mg/l] but exception is in case of HAN (RS).

Nitrate

Nitrogen is essential element and in form of nitrogen gas as it converted into nitrate by rhizobium bacteria which act as nutrient for plants. But its excess amount causes blue baby syndrome [which causes death] when converted to nitrite. In district like Jaipur, HAN (BS) and Alwar (BS) nitrate value is very high. Nitrogen is important for making protein in muscle, skin, blood etc. So it is very much necessary to maintain nitrogen in body.

Fluoride

Fluoride helps in prevention of tooth decay but in opposite case it cause skeletal fluorosis etc. when exceed to permissible. In district like churu (BS), marwar (RS) and Jhunjhunu fluoride is beyond of permissible range. While in most of the districts it is zero.

Chromium

In all districts it is beyond of permissible range and hence there is no relaxation. We have to care it either by avoid drinking source or by using suitable filtering process like use of RO, distillation or by ion Exchange, because by drinking contaminant water we will get affect by skin irritation, lung tumour etc.

Sulphate

This parameter is within permissible limit no health effect will arise.

Sodium and Potassium

Both of these are within the permissible range.

5. CONCLUSION

Above parameters which described above from them mostly parameter is beyond of permissible range except, ferrous sulphate sodium and potassium. It is not necessary that the parameter must be within permissible limit its deficiency also create trouble. Hence from study we came to an conclusion that direct source of water is also contaminated. Most people used bus and train as their way to reach an destination and during journey they use railway station and bus stand tap water as their drinking water source. But it is very worst condition that parameters are not within and are not fulfilling desirable limit due which we suffer. So it is very much necessary to take precautionary measures as required to removal of parameters which is harmful for us. Remediation methodology should be carry out as soon as possible by government because if water will remain contaminant in these sampling point then Million of people suffer from these.

ACKNOWLEDGEMENT

This study becomes possible by moral support of prof. K.C Sharma HOD Environmental science ,Dr. Abhinav Jha who support me lot and financial support done by subhra bharti and shilpi bharti during my study period these persons help me lot. But not at least I would like to thanks Rakesh Kumawat for providing me bike.

REFERENCE

- [1] APHA (1985), standard methods for examination of water and waste water, 20th edition, American public health association, Washington D.C.
- [2] Baird, Colin 1995. Environment chemistry W.H. freeman and co. New york.
- [3] Bates, R.G. 1973 Determination of pH theory and practice. John wiley and sons, New york
- [4] Burriel-Martif and J.Ramirez-Munoz 1957 flame photometry a manual of methods applications D Van Nastrand Co., Princeton N.J
- [5] Dara, S.S 1998 A text Book of Environmental chemistry and pollution control S.chand and Co. ltd
- [6] Dean, J.A. 1960 flame photometry. McGraw Hill publishing Co. new york
- [7] Durst, R.A 1975 Standard Reference Material Standardization of pH measurements. NBS special publication 260-53, national bureau of Standards Washington, D.C
- [8] DWAF(1998) quality of domestic water supply. Assessment Guide 1(2ndEd.). Department of water affair and forestry, Department of health and water research commission.
- [9] EEC,1991b: Nitrate Directive. Council directive 91/676/EEC of 12 dec.1991 concerning the protection of water against pollution caused by nitrate from agricultural sources.
- [10] Furman N.H 1962 standard methods of chemical analysis 6th edition D.Van Nostrand co. Inc Princeton , N.J.
- [11] Goetz, C.A and R.C. smith 1959 evaluation of various methods and reagents for total hardness and calcium hardness in water. Iowa state j. sci. 34:81
- [12] Golterman, H.L., R.S. clymo and M.A.M ohnstad.1978 methods for physical and chemical analysis of freshwater. IBP handbook number 8 blackwell scientific publications
- [13] Haynes R.1982 environmental science method chapman and Hall London
- [14] Howard, C.S. 1933. Determination of Total dissolved solids in water analysis. Ind. Eng. Chem anal edition 5-4