PHYSICOCHEMICAL ANALYSIS OF DRINKING WATER SUPPLIED IN URBAN TOWNS OF BHARATPUR DISTRICT (RAJASTHAN)

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ABSTRACT

The problem of safe drinking water in Rajasthan is serious due to the excess of Fluoride, Nitrate, Hardness, Total dissolved solids. Physico-chemical characteristics of Drinking Water supplied by PHED in Bharatpur district (Rajasthan) were studied. The studies were carried out in the month June 2013. Some important physico-chemical parameters like pH, total dissolved solids (TDS), alkalinity, Fluoride, Nitrate, Total hardness (T.H.) were analyzed in collected water samples. Several sampling points have been selected. It has been observed that parameters like Fluoride, Nitrate and Total Hardness, Total dissolved solids have higher values in some water samples as compared to BIS standards. A higher concentration of these ions causes diseases to human beings and affects vegetation.

Key words: Physico-chemical parameters, Fluoride, Nitrate, Bharatpur district.

INTRODUCTION

Water is essential for all living things. Without water, life of any kind is not possible. Man needs water for drinking, cooking, washing, bathing, irrigation industry etc. Ground water is the most important source of water supply for drinking, irrigation and industrial purposes. The natural quality of ground water tends to be degraded by human activities. There is sharp decline in the ground water table and changes in the geochemistry of ground water due to excessive use of ground water.

The main causes for pollution of ground water are city drainage, industrial wastes and excessive use of ground water. It is essential to study the physicochemical characteristics[1-8] of water.

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Bharatpur district is situated in the eastern part of Rajasthan state between North latitude $26^o 22'$ and $27^o 83'$, longitude between $76^o 53'$ and $78^o 17'$. It has an area of 5066 sq. Kms. with an altitude of 100 m above MSL. The urban agglomeration of Bharatpur-city is situated at the foothills of Arawali mountain series. There are three main seasonal rivers which are Banganga, Ruparel and Gambhir. It has quite variations in seasons. Summer is quite hot and winter is very cold which has high temperature up to $49^o C$ & low as $3.5^o C$. It has an average rainfall of 67.5%.

In 2011, Bharatpur had population of 2, 548, 462 which has the growth rate of 21.29%. The population density is 503 people per sq. Kms.Bharatpur district has nine urban towns namely Bharatpur city, Bhusawer, Bayana, Deeg, Kumher, Nagar, Kaman, Nadbai, Weir. Most of the drinking water is supplied clear water reservoirs (CWR) and supply reservoirs (SR), which are filled by tube-wells. In Bharatpur city, the surface water and tube well water are supplied through CWR or SR in the distribution system.

EXPERIEMENTAL

Water samples were collected in cleaned borosilicate bottle washed with acetone in month of June 2013 at the selected sites. Borosilicate glass wares, distilled water and E-Merck reagents were used for the analysis.

Turbidity was measured by Nephelometer. All the samples have no turbidity. pH value of water samples were measured by using Systronics digital pH meter.

Total hardness was determined by complexometric titration with EDTA using Eriochrome black-T- as an indicator. Total Alkalinity of water was determined by titrating with $N/50$ H_2SO_4 using phenolphthalein and methyl orange as indicator.

TDS was estimated by digital TDS meter Systronics make 308.

Nitrate ions are measured by UV spectrophotometer as well as visual comparison method. Fluoride ion was estimated by Orion fluoride ion-meter (five-star). Different methods were used for this analysis[1-7].

RESULTS AND DISCUSSION

The pH of water indicates the degree of deterioration of water quality. The desirable pH range necessary for drinking water is from 7.0 to 8.5. The pH of water samples in the study area ranged from 6.9 to 8.1.

Table 1: Chemical parameters of water supplied from CWR & SR

Name of Town: Bharatpur
No. of Tube-wells: 76 Surface water: Bandhbaretha

Name of source & location	pH	Alkalinity	Total hard (TH)	NO_3^-	TDS	F^-
S. R. Atal bandh	7.6	160	610	10	2190	0.28
C. W. R. Mallah Head works	7.2	60	90	7	255	0.50
C. W. R. Heeradas	7.2	100	140	9	532	0.22
C. W. R. Anah gate	7.1	40	110	5	407	0.27
C. W. R. SPM Nagar	7.5	240	610	24	1889	0.82
C. W. R. Ranjeet Nagar	7.7	390	860	30	2317	0.70
C. W. R. SIMCO	7.9	460	1230	32	3024	0.55
C. W. R. DeenDayal Nagar	7.8	370	920	26	2413	0.54
C. W. R. Krishna nagar	7.6	260	410	23	1291	0.36
C. W. R. Jawahar Nagar	7.0	50	90	0	413	0.25
C. W. R. CDBP	7.0	50	60	0	183	0.39
S. R. I. T. I.	7.5	320	830	19	2132	0.73

Table 2: Chemical parameters of water supplied from CWR & SR

Name of Town: Bhusawer
No. of Tube-wells: 08

Name of source/Location	pH	Total alkalinity	Total hard (TH)	NO_3^-	TDS	F^-
C. W. R. old campus	7.5	210	630	33	1950	0.49
S. R. old campus	7.5	140	620	33	1980	0.37
S. R. NEWcampus	7.2	120	510	98	1429	0.73
C. W. R. new campus	7.2	160	460	78	1426	0.76
C. W. R. Kunda wala	7.4	110	320	13	1074	0.72

Table 3: Chemical parameters of water supplied from CWR & SR

Name of Town: Bayana
No. of Tube-wells: 13

Name of source/Location	pH	Total alkalinity	Total hard (TH)	NO_3^-	TDS	F^-
C. W. R. Campus	7.2	80	150	35	680	0.20
S. R. Campus	7.2	60	160	33	658	0.20
C. W. R. Hudco	7.4	180	410	16	1229	0.15

Table 4: Chemical parameters of water supplied from CWR & SR

Name of Town: Deeg
No. of Tube- wells: 19 Open well: 01

Name of source/Location	pH	Total alkalinity	Total hard (TH)	NO_3^-	TDS	F^-
C. W. R. CampusPHED	8.0	730	1760	14	4740	0.24
S. R. CampusPHED	8.1	760	1830	13	4750	0.09
C. W. R. Pahadtal wala	7.3	310	540	20	1660	0.08
S. R. Pahadtal wala	7.9	810	2360	5	6305	0.15
C. W. R. Sahiyad	8.1	930	1940	5	5810	0.46
C. W. R. Goverdhan gate	7.9	720	1730	13	4740	0.49

Table 5: Chemical parameters of water supplied from CWR & SR

Name of Town: Kumher
No. of Tube-wells: 12

Name of source/Location	pH	Total alkalinity	Total hard (TH)	NO_3^-	TDS	F^-
C. W. R. Sirsai wala	7.2	290	460	19	1521	0.62
C. W. R. Gaushala	7.3	310	490	15	1630	0.43
C. W. R. Lakhan	7.5	420	830	59	2314	0.23
C. W. R. Campus	7.9	380	830	54	2314	0.20

Table 6: Chemical parameters of water supplied from CWR & SR

Name of Town: Nagar
No. of Tube-wells: 14

Name of source /Location	pH	Total alkalinity	Total hard (TH)	NO_3^-	TDS	F^-
S. R. Khoraki	7.7	380	1170	34	3168	0.59
C. W. R. Khoraki	7.9	680	1490	10	4104	0.37
C. W. R. Main pump house	7.8	480	1170	35	3125	0.25
C. W. R. Panchayat samiti	7.3	360	890	25	2640	0.37

Table 7: Chemical parameters of water supplied from CWR & SR

Name of Town: Kaman
No.ofTube-wells:20

Name of source /Location	pH	Total alkalinity	Total hard (TH)	NO_3^-	TDS	F^-
C. W. R. Luhesar	7.0	40	80	4	339	0.46
C. W. R. Kot ke pass	7.4	320	860	28	2266	0.96
C. W. R. Main pump house	8.1	392	720	31	2499	0.51

Table 8: Chemical parameters of water supplied from CWR & SR

Name of Town: Nadbai
No. of Tube-wells: 12

Name of source/Location	pH	Total alkalinity	Total hard (TH)	NO_3^-	TDS	F^-
C. W. R. Main pump house	7.5	190	520	19	1789	1.0
S. R. Main pump house	7.5	180	510	19	1763	1.20
S. R. Dashera Maidan	7.9	430	1340	39	3312	0.73
C. W. R. Dashera Maidan	7.9	420	1360	42	3322	0.78
S. R. Gandhi park	7.3	160	430	16	1299	0.53
C. W. R. Gandhi park	7.3	150	410	30	1218	0.49

Table 9: Chemical parameters of water supplied from CWR & SR

Name of Town: Weir
No. of Tube-wells: 07

Name of source /Location	pH	Total alkalinity	Total hard (TH)	NO_3^-	TDS	F^-
S. R. New Campus	7.2	110	260	36	840	0.21
S. R. Old Campus	7.2	100	270	19	882	0.26
C. W. R. Old Campus	7.2	90	280	19	896	0.23
C. W. R. Ramaspur	7.5	130	320	2	1176	0.47

Table 10: Indian standards for drinking water

S. No.	Parameter	Desirable limit	Undesirable effect	Permissible limit
1	pH	6.5 to 8.5	Beyond limit, effect mucous membrane	–
2	Total hardness	300 mg/L	Adverse effect on domestic purposes, encrustation in water supply structure	600 mg/L
3	Dissolved solids	500 mg/L	Palatability decreases, cause gastro-intestinal irritation	2000 mg/L
4	Nitrate	45 mg/L	Methanemoglobinemia	100 mg/L
5	Fluoride	1.0 mg/L	Fluorosis, fluoride may be kept as low as possible	1.5 mg/L

      The desirable limit for total alkalinity is 200 mg/L. The value of total alkalinity of water samples varied from 40 to 930 mg/L. Turbidity in any water samples were not found. The total hardness was found in the range of 60 to 2360 mg/L which shown very high values.

      The value of nitrate ions were ranged between 0.0 to 98 mg/L. High Nitrate ion concentration causes Mathenemoglobinemia in young children. The value of TDS was found in water samples between 407 to 6305 mg/L. It shows high TDS range which cause stomach ailment. The value of fluoride ions in sample were found between 0.08 to 0.82 mg/L. High fluoride in concentration causes dental and skeletal fluorosis.

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