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QUANTITATIVE ASSESSMENT OF UNDERGROUND WATER QUALITY AT SAMBHAL, MORADABAD : A CASE STUDY

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ABSTRACT

Underground water quality at Sambhal, Moradabad was analyzed at eight different sites with reference to different physiochemical parameters following standard methodology of sampling and estimation. Calculated water quality index indicated that ground water is severely polluted at most of the sites of study, however, it is good in quality at other three sites. Calculated results are similar to the estimated values. Present study is one step ahead in the field of environmental studies. People exposed to polluted water are prone to health hazards and ground water quality management is urgently needed.

Key words: Ground water quality, Water quality index, Unit weight, Quality rating.

INTRODUCTION

Water is one of the most common resources used on earth. Barely only of it is fresh. 97% of earth's water is too salty or polluted. 2% is too far underground to reach that leaves only 1% for clean drinking water. Since, we have a low supply of fresh water, we need to conserve it and its quality as well. People who do not have access to clean water have to use it wisely and protect it or else it will become endangered.

Life on earth would be non-existent in absence of water and it is essential for everything on our planet to grow and prosper. Although, we as human beings recognize this fact, we disregard it by polluting our water resources. Clearly, the problems associated with water pollution have the capabilities to disrupt life on our planet to a great extent. Several laws have been passed to combat water pollution but the government alone cannot solve the entire problem.

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It is ultimately up to us to be informed, responsible and involved when it comes to the problems we face with our water. We must become familiar with our local water resources, its water quality and learn about ways for the management and conservation of water quality[1-3]. Moradabad is a 'B' class city of western Uttar Pradesh. It is situated at the bank of Ram Ganga river and its altitude from the sea level in about 670 feet. It is extended from Himalaya in north to Chambal river in south. It is at 28° 20', 29° 15' N and 78° 4', 79° E. Sambhal is head quarter of tehsil previously a part of Moradabad district now of Sambhal district itself. The total area of Sambhal Tehsil is 45 Km^2 with total population of more than 3 lacs. It is famous for Mentha production and Seeng work. Silver foil making is also prominent.

Water Quality Index (W.Q.I.) has been regarded as one of the most effective way to communicate water quality. The index is basically a mathematical means of calculating a single value from multiple test results. The index result represents the level of water quality in a given water basin, such as lake, river or stream and aquifer.

The water quality index can be used to monitor water quality changes in a particular water supply over time or it can be used to compare a water supply quality with other water supplies in the region or from around the world. The results can also be used to determine if a particular stretch of water is considered to be 'healthy'[4,5].

EXPERIMENTAL

Thirteen physico-chemical parameters namely pH value, conductivity, alkalinity, total dissolved solids, hardness, dissolved oxygen, biological oxygen demand, chemical oxygen demand, calculated magnesium, fluoride, chloride and iron were estimated following standard methods of sampling and estimation[6].

The statistical data obtained through quantitative analysis of underground water and water quality standards of World Health Organization[7] are used for calculating water quality standards. Water quality indices of underground drinking water collected at different sites at Sambhal, Moradabad were calculated using the methods proposed by Horton[8] and modified by Tiwari and Mishra[9]. According the role of various parameters, on the basis of importance and incidence of ideal value of different physico-chemical parameters. Even, if they are present, they might not be the ruling factor. Hence, they were assigned zero values.

On the basis of calculated values of water quality indices quality status is assigned to include the collective role of various physico-chemical parameters on the overall quality of

drinking water. On the basis of a number of water pollution studies, following assumptions were made with reference to assess the extent of contamination or the quality of drinking water. The assumptions are:

WQI < 50 : Fit for human consumption

WQI < 80 : Moderately polluted

WQI > 80 : Excessively polluted

WQI > 100 : Severely polluted

RESULTS AND DISCUSSION

Number, names and description of different sites are presented in Table 1. Physicochemical parameters, their W.H.O. standards and assigned unit weight (Wn) are given in Table 2, site-wise estimated actual value (Vn) calculated quality rating (Qn) and calculated value of Wn log10 Qn of different parameters are listed in Table 3. Calculated WQI values are presented in Table 4.

Critical analysis of data and its comparison with WHO standards and assumptions for WQI reveal following facts regarding the underground water quality at public places of Sambhal, Moradabad during the period of study.

Estimated values of different parameters indicate very clearly that at most of the sites their values are much higher than prescribed WHO drinking water standards and water is polluted and unfit for human consumption and other domestic purposes.

Table 1: Description of sampling sites

Site No.	Name of site	Location	Type of source	Usage	Water quality
I	Bus stand	400 m. North West to Tehsil	Indian mark II	Drinking	Colourless, Odourless
II	Hospital	500 m. East to site no. I	Indian mark II	Drinking	Water turns yellow on standing
III	Nakhasa	500 m. South to tehsil	Indian mark II	Drinking	Colourless, Odourless

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Site No.	Name of site	Location	Type of source	Usage	Water quality
IV	UPSRTC Bus stand	Adjacent to site No. II	Indian mark II	Drinking	Colourless, Odourless
V	Chaudhary Sarai	400 m. South to site No. IV	Indian mark II	Drinking	Colourless, Odourless
VI	Pakka Bagh	500 m. North to tehsil	Indian mark II	Drinking & irrigation	Colourless, Odourless
VII	Ladam Sarai	500 m. South East to tehsil	Indian mark II	Drinking & irrigation	Colourless, good in taste
VIII	Milk factory	600 m. South to site No. VII		Drinking	Colourless, Odourless

Table 2: Physico-chemical parameters, their W.H.O. standards and assigned unit weight (Wn)

S. No.	Parameters (Units)	Recommended WHO standard	Assigned unit weight (Wn)
1	pH	8.0	0.017875
2	Conductivity (μS/cm)	0.30	0.476667
3	Dissolved solids (mg/L)	500	0.000286
4	Alkalinity (mg/L)	100	0.001430
5	Dissolved oxygen (mg/L)	5.00	0.028600
6	BOD (mg/L)	6.00	0.023833
7	COD (mg/L)	10.00	0.01430
8	Hardness (mg/L)	100.00	0.001430
9	Calcium (mg/L)	100.00	0.001430
10	Magnesium (mg/L)	30.00	0.004767
11	Fluoride (mg/L)	1.00	0.143000
12	Chloride (mg/L)	200.00	0.000715
13	Iron (mg/L)	0.50	0.286000

Table 3: Site-wise estimated actual value (Vn), calculated quality rating (Qn) and calculated value of Wn $\log_{10}$Qn of different parameters

S. No.	Parameter	Site I			Site II			Site III			Site IV		
		Vn	Qn	Wn $\log_{10}Qn_1$	Vn	Qn	Wn $\log_{10}Qn_2$	Vn	Qn	Wn $\log_{10}Qn_3$	Vn	Qn	Wn $\log_{10}Qn_4$
1	pH	7.33	33	0.027	7.02	2	0.005	7.11	11	0.019	7.17	17	0.022
2	Conductivity (µS/cm)	0.57	190	1.086	1.95	650	1.340	1.63	543	1.304	1.08	360	1.219
3	Dissolved solids (mg/L)	374	75	0.001	1287	257	0.001	1075	215	0.001	711	142	142 0.001
4	Alkalinity (mg/L)	312	312	0.004	472	472	0.004	384	384	0.004	380	380	0.004
5	Dissolved Oxygen (mg/L)	0.90	143	0.062	1.80	133	0.061	0.60	135	0.061	1.20	140	0.061
6	BOD (mg/L)	10	167	0.053	65	1083	0.072	35	583	0.066	19	317	0.060
7	COD (mg/L)	7	70	0.026	100	1000	0.043	60	600	0.040	23	230	0.034
8	Hardness (mg/L)	264	264	0.003	700	700	0.004	700	700	0.004	408	408	0.004
9	Calcium (mg/L)	164	164	0.003	468	468	0.004	420	420	0.004	280	280	0.003
10	Magnesium (mg/L)	100	333	0.012	232	773	0.014	280	933	0.014	128	427	0.013
11	Fluoride (mg/L)	0.25	25	0.200	0.11	11	0.149	0.11	11	0.149	0.36	36	0.223
12	Chloride (mg/L)	39.04	19	0.001	350	175	0.002	164	82	0.001	119.20	60	0.001
13	Iron (mg/L)	0.67	134	0.608	0.80	160	0.630	0.35	70	0.528	0.42	84	0.550

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S. No.	Parameter	Site V			Site VI			Site VII			Site VIII		
		Vn	Qn	Wn $\log_{10}Qn_5$	Vn	Qn	Wn $\log_{10}Qn_6$	Vn	Qn	Wn $\log_{10}Qn_7$	Vn	Qn	Wn $\log_{10}Qn_8$
1	pH	7.22	22	0.024	7.38	38	0.028	7.46	46	0.030	7.40	40	0.029
2	Conductivity (µS/cm)	1.19	397	1.239	0.36	120	0.991	0.34	113	0.997	0.56	187	1.083
3	Dissolved Solids (mg/L)	788	158	0.001	234	47	0.000	233	47	0.000	370	74	0.001
4	Alkalinity (mg/L)	384	384	0.004	212	212	0.003	208	208	0.003	280	280	0.003
5	Dissolved Oxygen (mg/L)	1.00	142	0.062	0.60	146	0.062	0.60	146	0.062	0.80	144	0.062
6	BOD (mg/L)	20	333	0.060	35	583	0.066	30	500	0.064	40	667	0.067
7	COD (mg/L)	33	330	0.036	40	400	0.037	23	230	0.034	52	520	0.039
8	Hardness (mg/L)	480	480	0.004	192	192	0.003	168	168	0.003	256	256	0.003
9	Calcium (mg/L)	284	284	0.004	120	120	0.003	120	120	0.003	176	176	0.003
10	Magnesium (mg/L)	196	653	0.013	72	240	0.011	48	160	0.011	80	267	0.012
11	Fluoride (mg/L)	0.09	9	0.136	0.08	8	0.129	0.07	7	0.121	0.08	8	0.129
12	Chloride (mg/L)	56.80	28	0.001	17.10	9	0.001	12.10	6	0.001	47.40	24	0.001
13	Iron (mg/L)	0.46	92	0.562	0.02	4	0.172	0.08	16	0.344	0.03	6	0.223

Table 4: Site-wise calculated WQI values

S. No.	Site No.	Calculated WQI Value
1	Site I	122
2	Site II	213
3	Site III	156
4	Site IV	156
5	Site V	139
6	Site VI	32
7	Site VII	45
8	Site VIII	45

The calculated water quality index ranges from 122 to 213 from site No. I to site No. V and its value is 32 or 45 at other three sites. Highest pollution is observed at site no. II and it is lowest at site No. VI. The ground water is found to be severely polluted at almost all sites of study, however, it is not polluted at other three sites of study.

CONCLUSION

On the basis of calculated values of water quality index, it may be concluded that ground water is severely polluted at most of the sites of study, however, it is good in quality at other three sites. Calculated results are similar to the estimated values. Present study is one step ahead in the field of environmental studies. People exposed to polluted water are prone to health hazards and ground water quality management is urgently needed at Sambhal, Moradabad. It may also be added that WQI is once again proved to be a tool for collective assessment of water quality.

REFERENCES

1. M. Prasad, D. Kumar, S. Goyal and R. V. Singh, Int. J. Chem. Sci., **5**, 623-629 (2007).
2. N. Kumar and D. K. Sinha, Indian J. Env. Prot., **29(11)**, 997-1001 (2009).
3. N. Manonmani, Int. J. Chem. Sci., **8(1)**, 537-552 (2010).
4. M. Shahnawaz, K. M. Singh and H. Shekhar, Indian J. Env. Prot., **29(11)**, 945-952 (2007).

5. D. K. Sinha and R. Saxena, J. Environ. Science & Engg., **48(3)**, 157-164 (2006).

6. APHA, Standard Methods for Examination of Water and Waste Water, 19th Ed., AWWA, WPCF, Washington D. C. (1995).

7. W. H. O., International Standards for Drinking Water, Health organization, Geneva (1971).

8. R. K. Horton, J. Water Poll. Cont. Fed., **37**, 300 (1965).

9. T. N. Tiwari and M. Mishra, Indian J. Env. Prot., **5(4)**, 276-279 (1985).

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