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Analysis of Underground Drinking Water Quality

Abstract

The present study is to assess the underground drinking water quality at Moradabad with special reference to a number of water quality physico-chemical parameters at some prominent public places. Seasonal variation of water quality is also studied by analyzing the drinking water quality qualitatively as well as quantitatively for the three major seasons of the year namely summer, rains and winter. Fifteen different physico-chemical parameters are estimated at five public places with large footfall. It is observed that water with reference to most of the parameters studied is polluted in the catchment area under observation. Certain parameters showed seasonal trends while others stayed in the polluted range. It was found that underground water cannot be used without prior treatment at most sites throughout the year. Proper treatment procedures should be implemented immediately to ensure supply of clean drinking water.

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Introduction

Ground water is the principal source of drinking water in our country and an indispensable resource in our life. The degradation of water quality of a water body makes it so polluted that water can't even be used for its intended beneficial uses like bathing, recreation and as a source of drinking water[1] Potable safe drinking water is absolutely essential for healthy living. Adequate supply of fresh and clean water is a basic need for all human being on the earth. [2] Moradabad is a 'B' class city in western Uttar Pradesh having urban population of more than 38 lakhs. Geographically Moradabad is locted at the bank of Ram Ganga river and its altitude from the sea level is about 670 feet. It extends from Himalaya in North to Chambal River in South. District Bijnor and Nainital are in the North, Rampur is in the East, Ganga river is in the West and district Budaun is in the South of district Moradabad. Moradabad is popular for its brass industries which are increasing rapidly in last few years. [3,4] The major industries are brassware, steel ware, paper mills, sugar mills, crushers, dye factories and a number of associated ancillaries. This extensive industrial activity and different kinds of human activities play their roles in multiplying the level of underground drinking water pollution. [5, 6]

Material and Method

Five different sites at Moradabad were selected in order to study the physico-chemical characteristics of underground drinking water of India Mark II (IM2) hand pumps. Details of sampling sites are given in Table 1. The samples were collected following the standard methods of sampling. The standard methods and procedures were used for quantitative determination of water quality parameters. All chemicals of anal R grade were used for this purpose. The standards prescribed by W.H.O. were used for comparing different water quality parameters. [7] The estimated parameters are - pH value, conductivity, temperature, turbidity, dissolved oxygen, biological oxygen demand, chemical oxygen demand, total hardness, chloride, total solids, total dissolved solids, total suspended solids, alkalinity, iron and fluoride. [8 to 15]The estimated values of these fifteen parameters in all the three seasons namely summer, rains and winter are given in Table 2 [16 to 20]

Results and Discussions

Underground drinking water samples of five different sites at Moradabad is collected and analyzed qualitatively as well as quantitatively for fifteen water quality parameters following standard methods and techniques of sampling and testing. Three samples of each site for every season were collected and the averages of three values are reported in results.

The estimated values of pH and alkalinity clearly indicate that water at all the sites is alkaline in nature. A slight decrease in alkalinity is observed during rainy season. Conductivity values are high at all sites but water quality at Site 5 is better than others in this aspect. Underground water of study area is turbid at all the sites for all three seasons except at Site 5. BOD and COD values are indicators of presence of biological and chemical matters in the water and it is observed that the water at all sites is polluted in this reference. Water at all sites is found to be hard and a decrease in hardness is observed in rainy season. Chloride and amount of solids remained well within range for all seasons across all sites. Higher amount of iron is found during summer and winter season though it decreases in rainy season. This high concentration of iron in water causes discolouration of standing water. Fluoride is an essential micronutrient and water at the sites of study is either deficient of this element or contaminated with a high concentration especially during winters.

Site-wise and season-wise values of different parameters indicate that water is alkaline throughout. In winters, conductivity levels drop as compared to summer and rains at all sites Turbidity, iron and fluoride concentrations display increasing trends from summer to rainy to winter season. There is no marked trend observed season-wise for BOD, COD, hardness and amount of solids. Seasonal variations of some important parameters are represented through figure 1 to figure 8.

Conclusions

The water at study area is found to be alkaline at all sites with high values of pH an alkalinity. High values of conductivity might be due to the presence of different ions.BOD and COD values show that the water is polluted at all sites and also indicate high concentrations of biological and chemical pollutants. Hardness values indicate that untreated underground water should not be used for drinking purposes. The amount of solids in water is not a matter of concern for the present study. Standing water is found to show discoloration which can be attributed to high concentration of iron in underground water. Water that is deficient or abundant of fluoride should be treated accordingly before consumption. Season-wise, alkalinity, BOD, COD, hardness and amount of solids do not show a marked trend. Conductivity decreases while turbidity, iron and fluoride concentrations increase from summer to rainy to winter season.

Underground water in study area is found to be polluted with reference to almost all the parameters estimated. No marked improvement in water quality is seen with change of seasons. Comparatively, water quality at Site 5 is better than the rest and water at Site 4 is the worst in almost all aspects. The water at most sites is unfit for consumption without proper prior treatment. A provision for suitable water treatment facility is need of the hour

Table 1 : Details of sampling locations

Sl. No.	Site No. and Name of site	Location of site	Type of hand pump	Depth of boaring	Type of source	Apparent water quality
1.	I, Bus Station	Approx 150 meter south east to collectorate	India Mark II	Approx. 33 meter	Only source	Water becomes turbid on standing
2.	II, Railway Station	Approx.100 meter south to collectorate	India Mark II	Approx. 30 meter	Only source	Water becomes turbid on standing
3.	III, Town Hall	Approx.150 meter south east to collectorate	India Mark II	Approx. 33 meter	Only source	Water becomes turbid on standing
4.	IV, Court	Near to collectorate	India Mark II	Approx. 30 meter	Only source	Water becomes turbid on standing
5.	VI, M.D.A. Office	Approx.3 k.m. west to collectorate	India Mark II	Approx. 30 meter	Only source	Neat and clear water

Table2.Site-wise and season wise estimated values of different physico-chemical parameters of underground drinking water at Moradabad

		SITE NO I			SITE NO 2		
		BUS STATION			RAILWAY STATION		
S.NO	**PARAMETER**	**SUMMER**	**RAIN**	**WINTER**	**SUMMER**	**RAIN**	**WINTER**
2	Temperature (^{0}C)	29	28	24	29	27	24
1	Conductivity (µS/cm)	1.14	1.13	0.84	1	0.97	0.9
3	pH	7.26	7.03	7.58	7.4	7.08	7.75
4	Turbidity (NTU)	20	25	28	2	2	15
5	DO (mg/l)	2.4	1.8	1.4	2.2	1.6	1.2
6	BOD (mg/l)	10	16	16	12	14	18
7	COD (mg/l)	60	60	160	80	68	60
8	TH (mg/l)	320	310	344	304	280	350
9	Chloride (mg/l)	52	64	70	56	52	90
10	TS (mg/l)	400	460	410	350	390	370
11	TDS (mg/l)	380	442	380	320	375	350
12	TSS (mg/l)	20	18	30	30	15	20
13	Alkalinity (mg/l)	388	350	245	384	250	250
14	Iron (mg/l)	1.2	2.35	0.3	0.28	0.3	0.2
15	Fluoride (mg/l)	1.07	0.64	3.03	1.05	0.71	3.23

Table 2 Contd.

SITE NO 4			SITE NO 5			WHO STANDARD
COURT			MDA OFFICE			
SUMMER	**RAIN**	**WINTER**	**SUMMER**	**RAIN**	**WINTER**	
29	28	24	27	26	25.5	NA
1.5	1.45	1.28	0.44	0.42	0.37	< 0.300µS/cm
7.21	7.02	7.31	7.76	7.37	7.98	6.5 - 8.5
14	16	19	1	2	0.4	< 5 NTU
3.4	2	2	1.7	0.8	0.8	> 5 mg/l
18	20	22	8	6	8	< 6 mg/l
60	60	160	100	112	30	< 10 mg/l
408	412	390	140	120	240	< 100 mg/l
86	90	130	24	28	40	< 200 mg/l
500	525	560	216	244	260	< 500 mg/l
470	490	520	180	230	240	< 500 mg/l
30	35	40	36	14	20	NA
430	390	225	208	145	320	< 100 mg/l
1.1	1.23	0.6	0.14	0.1	0.02	< 0.5 mg/l
1.25	0.84	4.1	0.5	0.11	2.85	1 mg/l

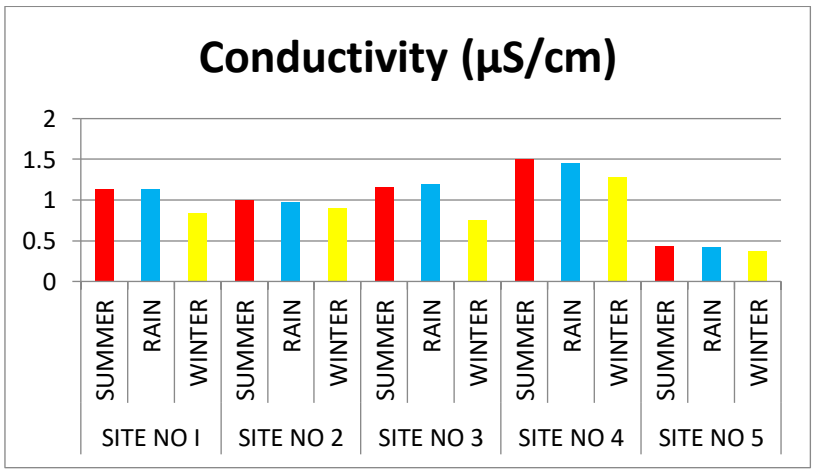

Fig. 1.Site wise seasonal variation of Conductivity

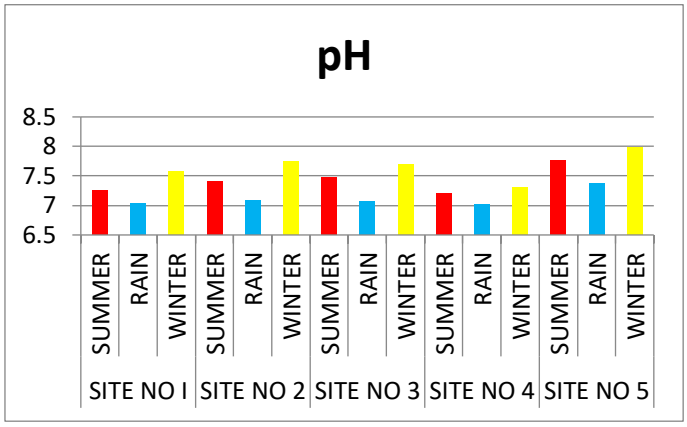

Fig. 2.Site wise seasonal variation of pH

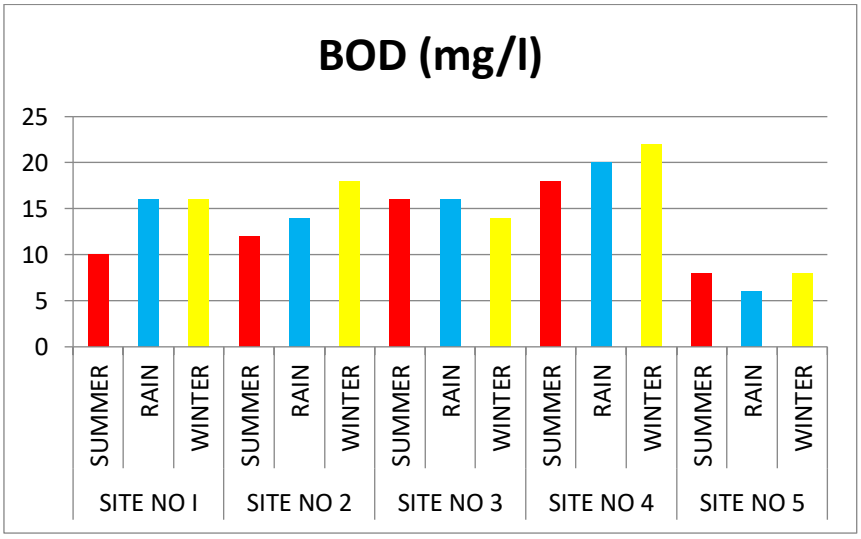

Fig. 3.Site wise seasonal variation of BOD

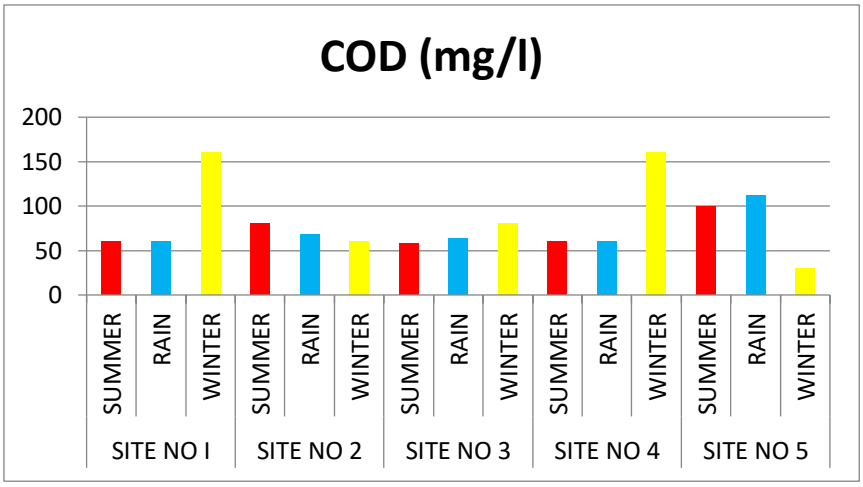

Fig. 4.Site wise seasonal variation of COD

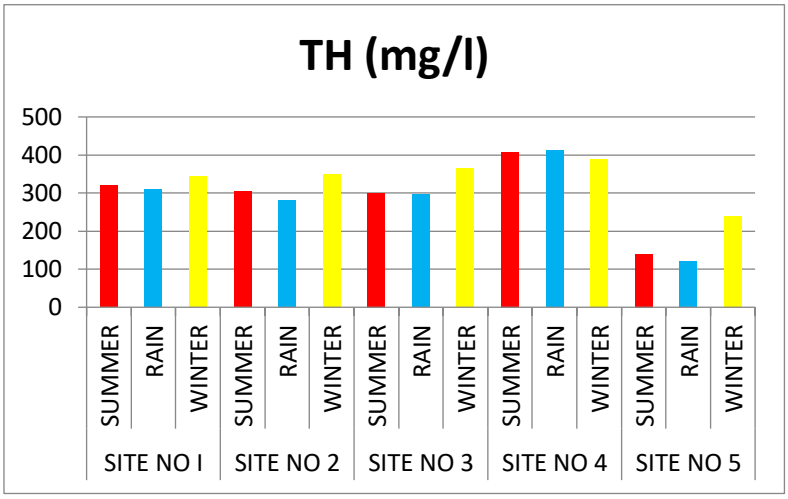

Fig. 5.Site wise seasonal variation of TH

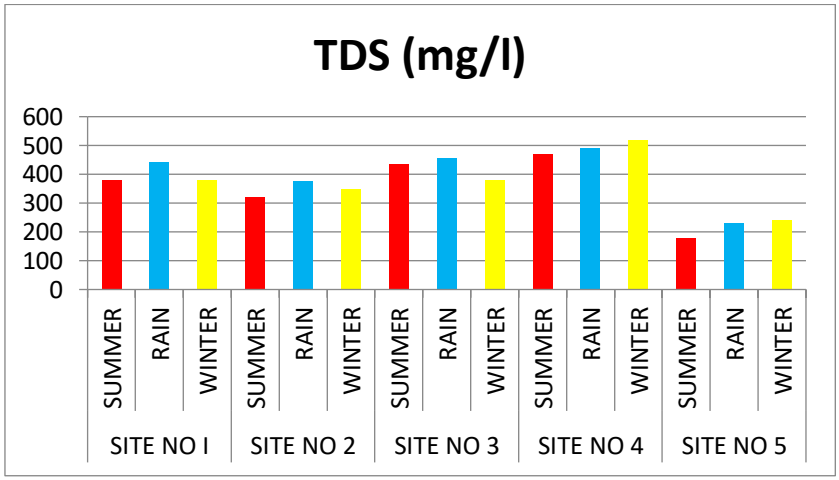

Fig. 6.Site wise seasonal variation of TDS

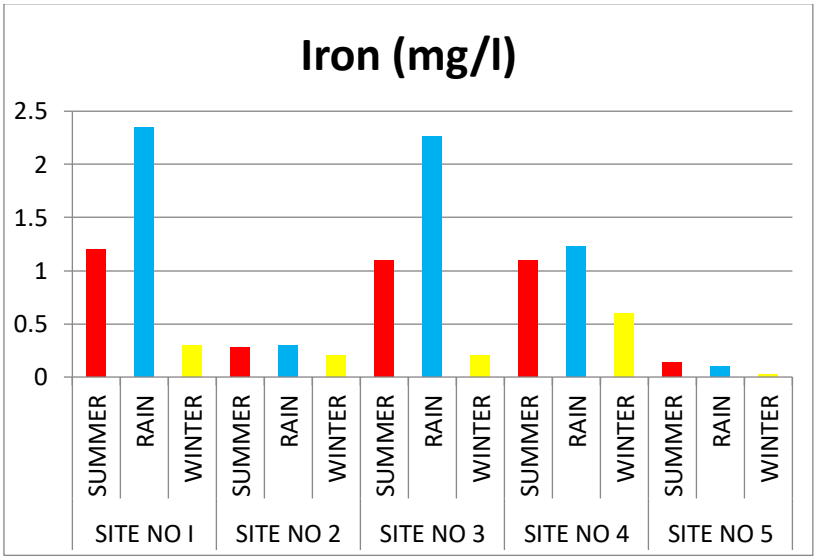

Fig. 7.Site wise seasonal variation of Iron

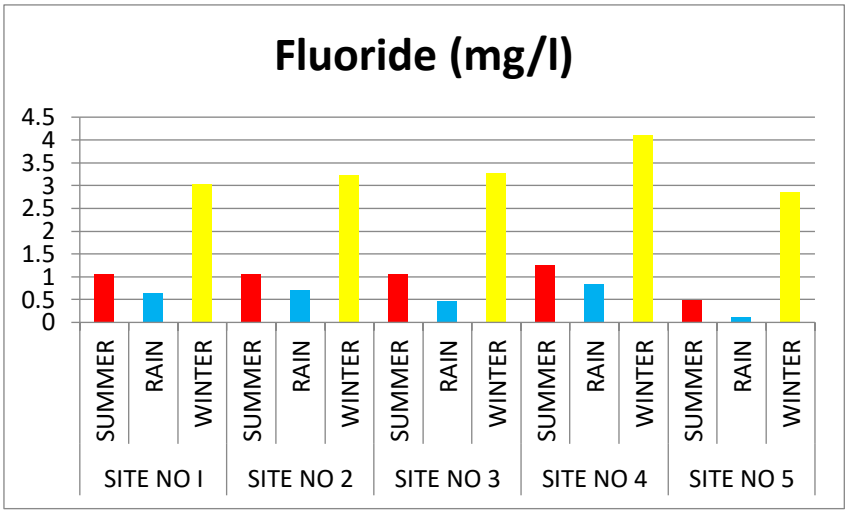

Fig. 8.Site wise seasonal variation of Fluoride

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