

Ground Water Quality Assessment in Different Villages of Bara Tehsil, Allahabad, U.P



Environmental Science

KEYWORDS : Pollution, Ground water, water quality

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ABSTRACT

Groundwater quality obtained from different villages of Bara Tehsil, Allahabad, U.P. The water samples was analyzed for their physicochemical characteristics pH, EC, TDS, Turbidity, Sulphate, Total Hardness, Calcium Hardness, Magenisium hardness, Acidity, Alkalinity, Chloride, Iron, and Fluoride etc. Experimental results shows the water the On comparing the results against drinking water quality standards laid by World Health Organization (WHO), it is found that some villages' water samples exceed the permissible limit.

INTRODUCTION:

Water is a major natural resource, a basic human need and precious natural asset, which should be conserved for future uses in a balanced manner. About 85 % of rural population in India is solely depended on ground water, which is depleting at a faster rate (Gajendran et al, 2014). Presently the quality and quantity of water is the important alarming environmental problems on at global and national levels. The pressure on water resources are from numerous sources and the impacts can take diverse forms, increase in with rapid urbanization, industrialization and agricultural development has resulted in high impact on quality and quantity of water in our country. Massive uses and inappropriate management of ground water are causing serious threat to the availability and quality of water (Nath et al., 2015). Water is the precious gift of nature to the human being. It is essential for the growth and maintenance of our bodies, as it is involved in a number of biological processes. The quality of water is of vital concern for mankind since it is directly linked with human health, protection of the environment and sustainable development. Increasing population and its necessities have led to the deterioration of surface and sub surface water. Ground water is the major source of drinking water in both urban and rural areas. The domestic sewage and industrial waste are the leading causes of ground water pollution (Garg et al., 1999).

MATERIAL AND METHODS

The present region of Bara Tehsil (Allahabad District) is situated with latitudes of 25°28'N 81°50'E, at the meeting point of the three sacred rivers of Saraswati, Yamuna and the Ganges. In the ancient days, the area was known as Vats country. There are 7 Tehsils in the district along with development blocks which are 20 in number.

Selected villages of Bara Tehsil for assessing water quality are Site 1(Chitauri), Site 2(Sendhuwar), Site 3(Levedi), Site 4(Bheeta), Site 5(Ghoorpur).The present study comprises and interpretation and analysis of water samples collected from four selected villages and compared with Standard values recommended by WHO.

STUDY AREA

The ground water samples were collected from Hand pumps the entire area (Bara Tehsil) of selected villages (Chitauri, Sendhuwar, Levedi, Bheeta, Ghoorpur) for the assessing the water quality for drinking purposes. The sampling sites are rural places and the samples are the major source of drinking water.



Fig.1. Sampling location of study area

PREPARATION OF WATER SAMPLES

The sample was collected from different villages January 2014 to April 2014, in clean plastic canes without any air bubbles. Prior the collection, the well cleaned sample canes were rinsed thoroughly with the water sample and immediately closed tightly. The hand pump continuously pumped prior to the sampling for avoid contamination from the surface.

ANALYSIS OF WATER SAMPLES

The water samples were analyzed at the Department of Environmental Science laboratory (SHIATS Deemed-to-be-University Allahabad). The Physico-chemical analysis of ground water was carried out for various water quality parameters such as Temperature, pH, Electrical conductivity, Total Dissolved Solid (TDS), Turbidity, Sulphate, Total Hardness, Calcium hardness, Magnesium hardness, Acidity, Alkalinity, Chloride, Iron, and Fluoride as per standard procedures of Standard of examination of water and waste water (APHA 1998).

RESULT AND DISCUSSION

The result of physical and chemical parameters obtained from the analysis of water samples are shown in Table 1

TEMPERATURE:

Temperature is most important factor for biologically significant, that plays an important role in living organism for metabolic activities. The temperature of all the sites varied from 24.88°C-29.20°C during all the four months i.e. January, February, March and April. The variation in the water temperature may be due to different timing of collection and influence of season. It is noted that high water temperature enhances the growth of micro organisms and may increase taste, odour, colour and corrosion problems.

Hydrogen Ion concentration (pH):

It is an important ecological factor and provides an important

piece of information in any types of geo-chemical equilibrium solidity calculations. The highest pH was found to be 7.75 in Bheeta during the month of April while the lowest value 6.90 was found in Ghoorpur in the month of February. pH was recorded within the permissible limit at all sites. The WHO recommended value for pH is 6.5-8.5.

Electrical Conductivity:

Electrical conductivity (EC) is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts (Dahiya and Kaur, 1999). The range of Electrical Conductivity was found between 0.56 to 4.20. The ground water of Sendhuwar found to be highest value of conductivity in the month of April. Similarly, the conductivity of water in Chitauri was noted to be 0.56 in January.

Total Dissolved Solids:

The highest value of TDS 2026.67 mg/l was recorded in the month of April in Sendhuwar where the lowest value of 430 mg/l in the month of February in Chitauri village, which may be due to the ground water pollution by domestic waste. The WHO recommended value for TDS is 500 mg/l. The TDS level of all villages was well above the permissible limit. TDS was recorded more than 500 mg/l at all the sites during sampling periods

Turbidity:

Turbidity of ground water samples was found to be in the range 0.61-5.76 NTU. The highest value of Turbidity was observed 5.76 NTU in the month of March in Ghoorpur and rest of all villages (Chitauri, Sendhuwar, Levedi, and Bheeta,) lie within the permissible limit. According to WHO specifications the desirable limit of turbidity in water is 5 NTU.

Sulphate:

Sulphate occurs naturally in the water as a result of leaching of gypsum and other common minerals (Manivaskam N., 2005). The Sulphate concentration was observed between 0.34 mg/l to 161.65 mg/l. The permissible limit of Sulphate is 200 mg/l prescribed by WHO. The highest concentration of Sulphate was found 161.65 mg/l during the month of April in Sendhuwar and lowest concentration was found 0.34 mg/l in the month of January at Chitauri. The possible causes of increase sulphate concentration in groundwater sample due to the discharge of domestic waste, industrial waste and sewage.

Total Hardness:

Water hardness is caused primarily by the presence of cations such as calcium and magnesium and anions such as carbonate, bicarbonate, chloride and sulphate in water. The value of Total hardness was observed between 268 mg/l to 1848 mg/l CaCO_3 . Almost all sampling sites showed have permissible limit except Sendhuwar and Ghoorpur. WHO has specified the total hardness to be within 500 mg/l of CaCO_3 .

Calcium Hardness:

The concentration of calcium hardness as CaCO_3 was found in the range of 78-1455 mg/l CaCO_3 . The highest value was found in the groundwater of Sendhuwar in the month of January while the lowest value was recorded in the water of Chitauri in April.

Magnesium Hardness:

The Magnesium hardness was lies between 91-471.5 mg/l. The highest value was found in the groundwater of Sendhuwar in the month of March while the lowest value was recorded in the water of Chitauri in February. It may be due to the rock and minerals, sand, climatic factors and industrialization.

Acidity:

The Acidity was observed between 43.25-158.5 mg/l in different villages in Tehsil. The highest value was found in Ghoorpur groundwater sample in the month of February while the lowest value was recorded in the water of Chitauri in March.

Alkalinity:

The Standard desirable limit of alkalinity in potable water is 120 mg/l. The maximum Permissible level is 600 mg/L. The value of Alkalinity of groundwater exceeded standard desirable limit in all stations compared to the prescribed value but were within the maximum permissible limit, given by WHO. The Total Alkalinity value of groundwater samples ranged from 215-403.25 mg/l. The highest value of ground water samples was found in Bheeta during the month of January and lowest value was obtained from ground water samples in Chitauri during the month of February. The cause of Alkalinity is the minerals which dissolve in water from soil. The various ionic species that contribute to Alkalinity include Bicarbonate, Hydroxides; Carbonates from Alkalinity point of view quality of water samples in all regions is poor.

Chloride:

Chloride is important in detecting the contamination of ground. Its concentration increase rates of corrosion of metals in the distribution system. The permissible limit of chloride in drinking water is 250 mg/l. Chloride content of the ground water samples ranges from 15.62 mg/l to 532.33 mg/l. almost all Sites lie within the permissible limit except Sendhuwar and Ghoorpur.

Iron:

Iron is a very common element found in many of the rocks and soils of the earth's crust. Soluble ferrous iron is present in natural water. Iron is found where ground water containing ferrous iron is discharging into a lake through spring. The concentration of iron varied from 0.42 mg/l to 0.87 mg/l. The concentration of iron was well above permissible limit in all Sites. The permissible limit of Iron in drinking water is 0.3 mg/l prescribed by WHO. The highest concentration of Iron was found 0.87 mg/l during the month March in Sendhuwar and lowest concentration was found 0.43 mg/l in the month of April at Bheeta.

Fluoride:

The WHO recommended value for Fluoride 1.0 mg/l. The high concentration of Fluoride due to weathering and circulation of water in rocks and soils, Fluorine is leached out and dissolves in ground water. The highest concentration of Fluoride was found 1.26 mg/l in the month of February at Sendhuwar and lowest concentration was found 0.84 mg/l in January at Levedi. All Sites were well above permissible limit.

CONCLUSION:

This study reveals that ground water is one of the main source of drinking water in study area. Its quality is getting deteriorated due to untreated discharge of rural effluent. The use of chemical substances in agriculture like fertilizer, pesticides and herbicides, are the primary causes of the ground water contamination. 65 ground water samples collected for physico-chemical analysis of water samples from Chitauri, Sendhuwar, Levedi, Bheeta and Ghoorpur. Physico-chemical parameters of some sites are out of maximum permissible limit prescribed by WHO. Hence, these sample water cannot be absolutely fit for drinking. Some essential treatment needed to convert in drinkable water.

Table 1: Physico-chemical characteristics of ground water quality of different villages in Bara Tehsil

Sampling Sites	Sampling Months	PARAMETERS													
		Temp	pH	EC	Total dissolved Solids	Turbidity	Sul-phate	Total Hardness	Calcium Hardness	Magnesium Hardness	Acidity	Alkalinity	Chloride	Iron	Fluoride
CHITAUARI	JAN	26.75	7.72	0.56	554.50	1.47	0.34	341	131.5	209.5	49.5	314.25	16.11	0.45	1.08
	FEB	28.5	7.71	0.70	430.50	1.47	0.35	268	177	91	61.5	215	27.26	0.61	1.12
	MAR	28.75	7.40	0.73	461	0.85	3.47	340.5	141.5	199	44.25	264.25	50.27	0.59	0.98
	APR	29	7.69	0.74	467.67	1.19	5.49	286	78	200	60	275	45.19	0.79	0.98
	MEAN	28.25	7.63	0.68	453.42	1.24	2.41	308.88	132	176.88	53.81	276.13	34.71	0.61	1.04
SENDHUWAR	JAN	26	7.33	2.34	1660	1.96	13.38	1509.5	1117.5	392	77.75	324	183.5	0.57	1.23
	FEB	29	7.00	3.65	1925	1.31	16.23	1848	1455	393	143.5	254	342.32	0.59	1.26
	MAR	28.5	7.04	3.45	1997.50	2.56	107.05	1285	813.5	471.5	88.25	275.75	532.33	0.42	1.24
	APR	28.5	7.18	4.20	2026.67	3.13	161.65	1131.3	666.67	464.67	154	290.67	441.03	0.65	1.17
	MEAN	28	7.14	3.41	1902.29	2.24	75.58	1443.4	1013.17	430.29	115.88	286.10	374.79	0.56	1.22
LEVEDI	JAN	26.13	7.58	0.62	506.75	1.69	0.40	324	121	228	43.25	333.5	15.62	0.57	0.84
	FEB	28	7.39	0.80	488	1.19	0.40	284	126	158	99.5	256	41.33	0.56	1.12
	MAR	28.38	7.41	0.88	947.75	0.70	5.23	349	129	220	57.5	308	54.60	0.70	1.02
	APR	29	7.66	0.87	560.33	1.18	13.36	260.67	66.67	194	59.33	321.67	43.72	0.76	1.10
	MEAN	27.88	7.51	0.79	625.71	1.19	4.85	304.42	110.67	200	64.90	304.79	38.82	0.65	1.02
BHEETA	JAN	24.88	7.60	0.73	585.25	0.77	0.87	316	163.5	152.5	50	403.25	19.74	0.64	1.02
	FEB	26.45	7.40	0.79	538.50	0.99	0.89	397	156	241	99	276	52.48	0.56	1.06
	MAR	28.55	7.46	0.91	599.25	1.19	9.61	347.5	148	199.5	50.75	332.75	52.83	0.60	0.89
	APR	29.07	7.75	0.94	648.67	0.61	23.37	291.33	88.67	202.67	44.67	322.33	52.33	0.87	0.91
	MEAN	27.24	7.55	0.84	592.92	0.89	8.69	337.96	139.04	198.92	61.10	333.58	44.35	0.67	0.97
GHOORPUR	JAN	25.88	7.44	1.20	874.25	1.33	1.88	573.5	297.5	276	66.25	333	75.80	0.55	1.13
	FEB	29	6.90	1.48	907.50	1.93	1.91	644	471	173	158.5	265.5	273.47	0.46	1.08
	MAR	29.05	7.40	1.53	981.75	5.76	28.28	469.5	315.5	154	92.75	286.75	274.08	0.73	0.91
	APR	29.2	7.45	1.32	936	3.27	19.06	476.67	366	110.67	96.33	276.33	202.13	0.73	0.86
	MEAN	28.28	7.29	1.38	924.88	3.07	12.78	540.92	362.50	178.42	103.46	290.40	206.37	0.62	1.00
BIS Standard	Acceptable limit		6.5	-	500	5	200	300	75	30	-	200	250	0.3	1.0
	Permissible limit		8.5	-	2000	10	400	600	200	100	-	600	1000	1.0	1.5
WHO Standard			6.2-9.2	-	500	5	200	100	75	150	-	200	200	0.3	1.00

All values are in mg/l, except Temp, pH, EC and Turbidity. Unit of Temp are °C, EC are mmho/cm and Turbidity is NTU

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