

Physicochemical Characteristics of Groundwater in Different Sites of Agra City, Uttar Pradesh

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A systematic study has been carried out to evaluate the physicochemical characteristics of groundwater in Agra city. Six groundwater samples were collected from various locations during February 2018 to March 2018 and analysed for pH, turbidity, electrical conductivity, total dissolved solids, total alkalinity, total hardness, calcium, magnesium, fluoride and chloride following the standard methods and procedures. Present work revealed that groundwater is comparatively very hard and slightly alkaline. Fluoride contents vary from place to place. The sampling sites showed that the physicochemical parameters were not within the water quality standard and was not found fit for drinking.

Keywords: Physicochemical Characteristics, Groundwater in Agra city.

1. INTRODUCTION

Water is most important component for human survival and industrial development of country on earth [1]. Among various sources of water, groundwater is a vital natural resource for a multiplicity purposes such as drinking, domestic uses, Industrial cooling, power generation, agriculture, transportation and waste disposal. The increasing demand for water to meet domestic, industrial and agricultural need is placing great emphasis on development of groundwater resources in the country induces fast degradation of groundwater quality as well as the discharge of domestic sewage, industrial and agricultural wastes adding continuously contaminants to the groundwater system which considerably alter the physicochemical parameters. As the water is the most important component of ecosystem, any imbalances created by entering impurities to it can harm the whole ecosystem [2,3]. In the recent years, quality of groundwater has undergone a considerable change with respect to contamination of heavy metals. Groundwater contains various types of chemical pollutants and several other substances. Some of the components present in it may be beneficial or harmful for the life of human beings depending on their concentrations.

So, in the light of above, an attempt has been made to know the physicochemical properties of groundwater in Agra city. The analysed data were compared with standard values recommended by WHO [4]. It is important to aware the population of Agra city regarding the physicochemical parameters of groundwater because it is consumed by the most of the population of the city.

2. MATERIAL AND METHODS

Six bore wells were selected from different residential sites in the Agra city as given in Table 1. Sampling was done during February 2018 to March 2018. Water samples were collected in pre-cleaned sterilized one litre bottles and were analysed for pH, turbidity(NTU), electrical conductivity(EC), total dissolved solids(TDS), total alkalinity(TA), total hardness(TH), calcium(Ca⁺⁺), magnesium(Mg⁺⁺), fluoride(F⁻), and chloride (Cl⁻). The samples were filtered through Whatman filter paper no.- 4 and physicochemical analysis was carried out as per standard methods [5]. Fluoride was determined by visual comparison method making a series of standard solutions.

TABLE 1: SAMPLING SITES

S.No. of samples	Sites	Depth (Approx.)
GW-1	JP Colony, West Arjun Nagar	60 Mtr
GW-2	Nalanda Enclave, Shastri Nagar	30 Mtr
GW-3	RBS College, Agra	55 Mtr
GW-4	Shastri Nagar opposite IBS, Khandari	35 Mtr
GW-5	Kalindipuram, Mau Road	35 Mtr
GW-6	Ashoka Enclave, Dayalbagh	50 Mtr

3. RESULTS AND DISCUSSIONS

WHO [4] and BIS [5] drinking water standards and values of analysis of physicochemical parameters of experimental groundwater are given in Table 2. The observed pH values ranging from 7.20 to 7.65 showed that all samples are slightly alkaline and were found within the limit prescribed by WHO and BIS. The turbidity of samples was found from 6.2 to 9.8 NTU which exceeding WHO permissible limit. The cost of water treatment goes up when the groundwater becomes more turbid. Clear water is needed for manufacturing units which produce drinking product, food products, etc. Electrical conductivity varies from 2105 to 5700 micro Siemens/cm indicating medium to high salinity in the water samples. Total dissolved solids in the study samples were ranging from 1200 to 3500 mg/l. 50% of the samples were out of permissible limit. Generally, the higher TDS causes gastro-intestinal irritation to the human beings, but the prolonged intake of water with the higher TDS can cause kidney stones and heart diseases [6]. Samples which are having TDS more than 3000 water cannot be used even for irrigation purpose. If value of electrical conductivity and TDS were more than maximum permissible limit in samples, these water sample are not suitable for drinking. Total alkalinity value was found in the range of 300 to 550 mg/l. The alkalinity in ground water system is mainly due to carbonates, bicarbonates and hydroxides of calcium and magnesium ion [7]. The alkalinity values are the reasonably in limit as per WHO standards (1993). These constituents are the result of dissolution of minerals in the soil and atmosphere. The total hardness content of samples was found to be in the range from 490 to 1100 mg/l. The TH value for all the samples except GW-5 sample was out of maximum permissible limit. Calcium values were ranging 215 to 450

mg/l and magnesium values were ranging 111 to 340 mg/l. All samples were out of maximum permissible limit. Fluoride content of the groundwater samples was in the range of 0.7 to 1.80 mg/l. In this study fluoride content in 33.3% of the samples were out of the desirable limits. At high concentration, fluoride can increase risk of various health problems [8]. The chloride ion concentration of the samples obtained from the study area was found to be in the range 380 to 850 mg/l. High concentration of chloride ions (>250mg/l) in potable water imparts undesirable salty taste to water and people who are not accustomed to high chlorides may be subjective to laxative effects [9].

Table 2: Summary of physicochemical characteristics of groundwater samples compared with standard values of WHO and BIS.

Water quality parameters	WHO international standard limit 1993 & 1996		BIS 10500-2012 limit		Physicochemical parameters of groundwater samples					
	Most desirable	Maximum allowable	Acceptable	Permissible	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6
Appearance	-	-	-	-	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless
Odour	-	-	-	-	None	None	None	None	None	None
pH	7.0	8.5	6.5	8.5	7.65	7.30	7.20	7.40	7.45	7.40
Turbidity NTU	1	5	1	5	9.0	7.2	9.8	7.3	6.2	8.2
Electrical Conductivity (EC) μ S/cm	-	-	-	-	5700	2230	4820	2105	2280	5200

Total dissolved solids (TDS) mg/l	500	1500	500	2000	3500	1300	3200	1200	1600	2600
Total alkalinity (TA) mg/l	200	600	200	600	550	340	450	300	350	480
Total hardness (TH) mg/l	-	500	200	600	1000	800	1100	690	490	780
Calcium (Ca ⁺⁺) mg/l	75	200	75	200	450	340	390	320	215	280
Magnesium (Mg ⁺⁺) mg/l	50	150	30	100	340	120	270	120	98	111
Fluoride (F ⁻) mg/l	-	1.5	1.0	1.5	1.80	0.90	1.70	0.8	1.10	0.70
Chloride (Cl ⁻) mg/l	200	600	250	1000	850	430	520	470	490	380

4. CONCLUSION

The observed physicochemical parameters indicate that the quality of groundwater varies from bore well to bore well. Higher values of certain parameters of samples indicate that the groundwater is not suitable for drinking as such. So it is suggested that groundwater source in the study area should be analysed before use for its suitability for domestic purposes. The results also suggest that the contamination problem is increasing with

increasing the depth of bore well. Therefore, proper care must be taken to avoid contamination of groundwater.

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