Status Of Physico-Chemical Parameter Of Ground Water Of Gorakhpur City U.P. (India)

Priyanka Chaudhary, Kalawati Shukla, Jitendra kumar

ABSTRACT: The ground water is most prime water which has multipurpose use ranging from drinking to industrial and agricultural uses. The continuously increase in the level of pollution of water is a serious problem. The city of Gorakhpur is not untouched with this serious issue .The pollution level of the major water sources in and around the city is increase rapidly. The main objective of the present study is to study the variation of ground water quality in Gorakhpur district, by collecting 20 samples of water from hand pump from 20 locations well distributed with in Gorakhpur district were analyzed for different parameters such as pH, electric conductivity , chloride total ,free chlorine , hardness, fluoride, nitrate, iron, Turbidity, potassium. Groundwater is polluted from seepage pits, refuse dumps, septic tanks, barnyards manures, transport accident and different pollutant. Important sources of ground water pollution are sewage is dumped in shallow soak pits. It gives rise to cholera, hepatitis, dysenteries, etc. especially in areas with high water table.

Key Words: Ground water, Water quality, Hepatitis, Dysenteries, Turbidity, Nitrate

Introduction:

Ground water is considered as one of the purest forms of water available in nature and meets the overall demand of rural as well as urban population. With the growth of industry the ground water is made susceptible for contamination due to addition of waste materials. Waste materials from the factories percolate with rain water and reach aquifer resulting in erosion of ground water quality. Groundwater is used for domestic, industrial, water supply and irrigation all over the world. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population, unplanned urbanization, industrialization and too much use of fertilizers and pesticides in agriculture [8]. Ground water is threatened with pollution from seepage pits, refuse dumps, septic tanks, barnyard manures, transport accidents and different pollutants. Important sources of ground water pollution are sewage and other wastes otherwise. Raw sewage is dumped in shallow soak pits, this gives birth to cholera, hepatitis, dysenteries etc. especially in area with high water table. The industries of woolen, bicycles in areas of Punjab and Haryana contribute high amt., of Ni, Fe, cu, cr and cyanide to ground water. The Indian environmental mangers and researchers have explained the condition of freshwater resources in India and their management as a serious environmental problem which includes nutrition enrichment, acidification and domestic waste, agricultural waste, sewage and industrial effluents toxic substances identified as major impacts [11]. In India 70% of surface water resource and ground water reserves have been contaminated by biological, organic and inorganic wastes [9].

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Chennai city groundwater quality has resulted in saline groundwater nearly 10 km inland of the sea and similar problems can be found in populated coastal areas around the world [22].GIS technology has previously facilitated laborious procedures [19,1,2]. During the past two decades, various researches have reported its application in ground water modeling and quality assessment. The demonstration of spatial variations in ground water quality using GIS and ground water quality information maps of the entire polluted area in India. Assessment of ground water quality through spatial distribution mapping for various pollutants utilizing GIS technology and the resulted information on quality of water could be useful for policy makers to take remedial measures [3].

Sources of Groundwater Pollution:

The major sources of groundwater pollution are principally the same as those of soil pollution and include landfills (waste dumps), accidental spills, agriculture, septic tanks, and atmospheric deposition. Dissolved pollutants move with the percolating soil water into groundwater, while organic liquid pollutants may reach the groundwater autonomously. In addition, in areas where surface water infiltrates to groundwater, surface water pollution is a potential source of groundwater contamination. The groundwater is believed to be comparatively much clean and free from pollution than surface water. Groundwater can become contaminated naturally or because of numerous types of human activities; residential, municipal, commercial, industrial, and agricultural activities can all affect groundwater quality [21, 7, 10, 16, 5, 20, 13]. Contamination of ground,water can result in poor drinking water quality, loss of water supply, high clean-up costs, high costs for alternative water supplies, and potential health problems. A wide variety of materials have been identified as contaminants found in groundwater. These include synthetic organic chemicals, hydrocarbons, inorganic cations, inorganic anions, pathogens, and radionuclides [4](Fetter, 1999). The importance of water quality in human health has recently attracted a great deal of interest. In developing countries like India around 80% of all diseases are directly related to poor drinking water quality and unhygienic conditions [12, 14].

Materials and methods

Study area: Gorakhpur is situated 26º45' north latitude and 83 º 22' east longitudes, in Tarai belt of river Rapti and Rohni. It is situated in the eastern part of the state of Uttar Pradesh in India, near the border with Nepal. The principal town in the transghagar plain. The name of the city has been assigned after the name of Saint Guru Gorakhpur of 12th century. The location of the city is very important strategic being located quite near to Indo-Nepal Border and very well connected by Railway.

Collection of Water Samples and their Analysis

The samples of water were collected in the sterilized plastic containers of 2 liter capacity from the hand pump. The collected samples of the ground water were analyzed, for their physical and chemical parameters such as pH, electrical conductivity (EC), total dissolved solids (TDS), turbidity, dissolved oxygen (DO), Alkalinity, Total Hardness (TH),Chloride, Phosphate, sulphate, nitrate, iron using standard analytical methods described in (APHA, 2005). The methods used for estimation of various physico - chemical parameters are tabulated in Table 1.

Table 1- *Methods used for analysis of physico- chemical parameters*

S. No.	Parameter	Method
1	Ph	Digital pH-meter
2	Electrical Conductivity (µmhos/cm)	Digital Conductivity-meter
3	Turbidity (NTU)	Digital Turbidity meter
4	Alkalinity (mg/l)	Titrimetric method (With HCl)
5	TDS (mg/l)	Digital Conductivity-meter
6	Total hardness (mg/l)	Titrimetric method (with EDTA)
7	DO (mg/l)	Winkler method
8	Nitrate (mg/l)	Spectrophotometric method
9	Iron (mg/l)	Atomic absorption spectrophotometer (AAS)
10	Fluoride(mg/l)	Ion Selective Electrode
11	Chloride(mg/l)	Titrimetric method (With AgNO3)

Results and Discussion:

The analysis of ground water samples were carried out in according to the standard analytical methods (APHA, Standard methods). All the results are compared with standard permissible limit recommended by World Health Organization (WHO), listed in Table-3 and the statistical Parameters of ground water samples of study area are summarized in Table-2.

Statistical Analysis

In the present study Minimum, Maximum and Mean have been calculated of water quality parameters by using Excel spreadsheet for the experimental data. **pH -** pH is a term used universally to express the intensity of the acid or alkaline condition of a solution or it is a measure of the hydrogen ion concentration in water. The measurement of alkalinity and acidity of pH is required to determine the corrosiveness of the water. The standard values of pH for drinking water are given by WHO, between 6.5-8.5. The pH values of water samples varied between 6.05 to 7.59 and were found within the limit prescribed by WHO.

Electrical Conductivity – Conductivity is ability of water to carry an electrical current. It signifies the amount of total dissolved salts. On the basis of electrical conductivity, the water quality can be classified as poor, medium or good [6]. In the present study the higher electrical conductivity is 1270 µmhos/cm and lower electrical conductivity is 456 µmhos/ cm. When the values of Electrical conductivity is compared to the permissible limit (Table.3), which has been prescribed as 1400 µmhos/cm according to WHO which are found within the limit.

Turbidity- Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye. The measurement of turbidity is a key test of water quality. The value of turbidity is different from place to place. The turbidity values varied between 0.3 NTU to 1.2 NTU and found within the limits prescribed by WHO .The maximum permissible limit of turbidity is 5.0 NTU (Nephelometric Turbidity Unit).

Nitrate – Groundwater contains nitrate due to leaching of nitrate with the percolating water. The high nitrogen content in water reservoir is an indicator of organic pollution. It results from the added nitrogenous fertilizers, decay of dead plants and animals etc. The nitrate content in the study area varied in the range of 12.0 mg/l to 41.0 mg/l and found within the prescribed limit.

Fluoride- Fluoride is important in human nutrition for the normal development of bones. The required level of fluoride is 1.0mg/l to 1.5 mg/l. The higher concentration of fluoride in ground water appears to create dental, skeletal and non-skeletal fluorosis. Fluoride concentration in sampling sites ranges from 0.21 mg/l to 0.98 mg/l in ground water samples, with lowest value 0.21 mg/l in Basaratput and highest value 0.98 mg/l in Kaudiram as shown in Table-2, all values are found in within permissible limit.

Chloride: Chloride a major anion in potable and industrial water has no adverse effect on health, but imparts bad taste to drinking water. The chloride concentration serves as an indicator of pollution by sewage. Chloride contents in fresh water are largely influenced by evaporation and precipitation. Chloride ions are generally more toxic than sulphate to most of the plants and are best indicators of pollution [15]. The value of chloride varied between 101 mg/l to 139 mg/l. These values are within permissible limit, according to WHO.

Iron- Iron is the primary source for discolouration problems in the drinking water distribution system. Iron particles in water supplies cause various asthetic and opetational problems including bad taste. The values of iron shows that the range between 0.111mg/l to 0.305 mg/l. The ground water of Khajni show maximum iron 0.305 mg/l and Kaudiram show minimum iron 0.111 mg/l. These values are found within permissible limit according to WHO.

Total dissolved solids (TDS) -Total dissolved solids indicate the salinity behavior of groundwater. Total dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of Calcium, Magnesium, Sodium, Potassium, Manganese, organic matter salt and other particles [17]. In the present study finding TDS value varied from 288 mg/l to 487 mg/l (Table.3), which is within the prescribed permissible limits. The maximum TDS recorded in Doharighat and minimum in Khajni.

Alkalinity - Alkalinity of water is the capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and potassium. Total Alkalinity ranges from 298 mg/l to 598 mg/l. The maximum value was recorded in Gorakhnath mandir and minimum in GIDA. The values found during analysis within permissible limit according to WHO.

Dissolved Oxygen (DO): Dissolved oxygen is an important parameter in water quality assessment and biological processes prevailing in the water. The DO values indicate the degree of pollution in the water bodies. The DO values indicate the degree of pollution in water bodies. DO values varied from 3.88 mg/l to 4.98 mg/l. The maximum value was recorded in Sardarnagar and minimum in Khajni. The values found during analysis within permissible limit according to WHO.

Total hardness (TH) - Hardness is the property of water which prevents lather formation with soap and increases the boiling point of water. Hardness of water mainly depends upon the amount of calcium or magnesium salt or both [18]. Hardness although have no health effects it can make water unsuitable for domestic and industrial use. The value of total hardness is varies from 278mg/l to 477 mg/l. The maximum value was found in MMM Engineering College and minimum value in samples of Basaratpur.

Table.2. *Parameters of ground water sample of Gorakhpur city (U.P)*

S.No	Location	pH	EC	Turbidity	Alkalinity	TDS	TH	DO	Nitrate	Iron	Chloride	Fluoride
			µs/cm	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	MMM.engin-ering collage	7.02	856	0.4	383	458	477	4.39	39	0.139	187	0.50
2	Basaratpur	6.98	958	0.5	388	409	278	4.89	12	0.271	119	0.21
3	Reserve Police line	7.25	1256	0.3	372	437	429	4.21	18	0.219	150	0.32
4	Gita Vatika	6.54	956	0.9	354	367	358	4.87	23	0.232	178	0.67
5	Dohrighat	7.33	689	0.8	498	487	338	4.31	29	0.278	160	0.77
6	Bichhia colony	7.59	826	0.3	467	380	298	4.89	26	0.191	228	0.55
7	Rapti nagar	7.15	456	0.4	572	367	289	4.72	13	0.198	238	0.93
8	Pipiganj	7.45	689	0.9	580	332	436	4.89	21	0.289	139	0.58
9	Khora bazaar	6.98	570	0.6	398	369	356	4.96	17	0.264	154	0.52
10	Sahjanava	6.42	1151	0.5	467	293	432	3.89	38	0.287	238	0.91
11	Mohaddipur	7.02	545	0.8	490	389	428	4.21	25	0.249	227	0.25
12	Fertilizer road	7.10	1270	0.3	575	391	312	4.54	19	0.237	231	0.85
13	Gorakhnath mandir	6.95	475	0.3	598	363	295	4.76	28	0.256	167	0.45
14	Pipraich	6.05	1077	1.2	522	345	387	4.83	28	0.271	176	0.62
15	Sardar Nagar sugarmill	7.44	995	1.1	538	449	399	4.98	38	0.298	201	0.57
16	Jungal kaudia	7.25	789	0.6	469	478	448	3.94	41	0.199	219	0.38
17	Kaudiram	7.35	876	0.9	489	309	438	4.32	33	0.111	239	0.98
18	GIDA	7.22	830	0.6	298	327	355	4.87	37	0.139	188	0.83
19	Khajni	6.26	954	0.4	337	288	329	3.88	36	0.305	198	0.66
20	Medical collage	7.14	635	0.7	556	315	394	3.97	39	0.301	101	0.71
	Min	6.05	456	0.3	298	288	278	3.88	12	0.111	101	0.21
	Max	7.59	1270	1.2	598	487	477	4.98	41	0.305	239	0.98
	Mean	7.02	842.65	0.6 25	467.55	377.65	373.8	4.51	28	0.236	186.9	0.61

Table 3-*Standards for drinking water quality*

	Parameter	WHO
1	pH	6.5-8.5
2	EC	1400
3	Turbidity	5
4	TDS	500
5	Total hardness	500
6	Alkalinity	600
7	DO	5
8	Nitrate	45
9	Iron	0.3
10	Fluoride	1.5
11	Chloride	250

Conclusion

The analysis of ground water samples being collected from the different places of Gorakhpur city and all water quality parameters (pH, electrical conductivity, turbidity, total alkalinity, total hardness, chloride, nitrate, fluoride, iron, TDS, and DO are within the permissible limit as per WHO standards. In Gorakhpur city, the parameters analyzed have shown that they all are within the permissible limits for drinking water .It is safe for human being.

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