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Dr. Neerja Sharma
Associate Professor,
S.V. College, Aligarh,
Uttar Pradesh, India

Corresponding Author:
Dr. Neerja Sharma
Associate Professor,
S.V. College, Aligarh,
Uttar Pradesh, India

Analysis of water quality near bank of Yamuna River in Khair tahsil, Aligarh district

Dr. Neerja Sharma

Abstract
For the development of any society the most essential requirement is the availability of clean and uncontaminated water. Water quality not only affect the human beings but also animals and crops irrigated by water. Groundwater and surface water are two main sources for the consumption in industries, irrigation, domestic work and many other purposes. But due to unfair and selfish activities of human beings, quality of both sources gets deteriorated day by day. In the present work the physico-chemical assessment of groundwater of area near Yamuna River, passing through Aligarh district, have been carried out. Water quality of Yamuna River is very poor due to direct discharge of industrial effluents, chemicals, plastic and garbage in the river. As it moves from Delhi towards Mathura district passing through Aligarh district there are chances that it affects the quality of ground water of the area situated near the riverbank. Keeping this view, the ground water samples were analyzed from different villages of Tappal block in Khair tahsil of Aligarh district. Water samples were collected from handpumps, open wells tube wells in the month of February to May. These samples were analyzed for 14 water quality parameters. The results were compared with WHO and BIS standards.

Keywords: Groundwater, quality of water, river water, physico- chemical analysis, water quality parameters

Introduction
Water is the most essential constituent for the sustenance of life on the earth. It is most important factor for ecological balance in the world. The amount of fresh water is limited. Rivers, Ponds, lakes and groundwater are the main source of freshwater. For most of the communities groundwater is the major source of drinking water. Fresh water also required for industrial, agricultural and other domestic purposes. The gradual destruction and aggravated pollution of water resources affect the whole ecosystem. Now adays water quality is one of the main concerns for survival on earth. River water are heavily polluted and ground water quality also start deteriorating because of unethical practices of human beings. In past decades most of the civilization develop near riverbanks or other water resources Yamuna River is one of the major rivers of India. But its water quality is getting worse day by day due to discharge of large quantity of untreated industrial effluents and dumping of domestic and other wastes, runoff from agricultural fields, fertilizers and chemicals. Delhi onwards the highly polluted river moves towards Mathura and passes from Khair tahsil of Aligarh district. Due to floods and internal interaction between ground and surface water there are possibilities that quality of bank side groundwater may be affected. Based on the above facts the present study has been carried out to analyse the various physico-chemical parameters of ground water of area near the Yamuna River in some villages of Khair tahsil of Aligarh district.

Study Area
Aligarh is a north Indian district situated between ganga and Yamuna River at about 130 km away from Delhi. The district is famous for locks and hardware industry. Aligarh has semi-arid climate, influenced by monsoon. It has five tahsils and twelve blocks. Khair tahsil is approximately 20 kilometers away from Yamuna River and divided into two blocks, Khair town and Tappal. There are 91 villages in Tappal block. Some villages of Tappal block are situated near Yamuna River. Gharvara, Lalpur Raiyyatpur and Sherpur villages are among them. Ground water quality of these villages have been investigated in present study.

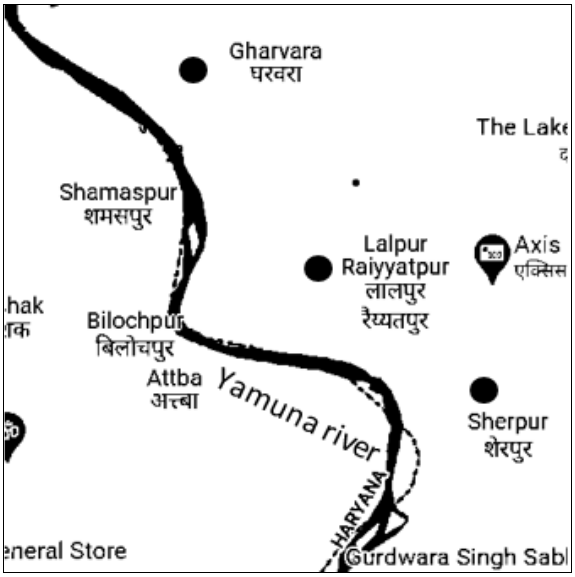

Fig 1: Study locations for water analysis

Material and Methods

The water samples were collected from tube wells, hand pumps and open wells, during the month of February to May, from twelve locations of three villages of Khair tahsil (4 sites in each village). Samples were collected in plastic air tight bottles of 1 litre capacity which are pre rinsed with nitric acid. These samples analysed for pH, conductivity, TDS, alkalinity, calcium, magnesium, sodium, potassium, chloride, sulphate, nitrate and fluoride ions. The method used for analysis are as per described by APPH. pH was measured by digital pH meter, electrical conductivity by digital conductivity meter, total hardness with EDTA method, TDS by gravimetric method add alkalinity by titration method. All ions were measured by colorimetric or spectroscopic method. Reagents used for analysis, were of AR-Merck/BDH grade.

Result and Discussion

Results obtained from analysis were evaluated as per prescribed by of BIS and WHO:

Table 1: Physico chemical data of ground water samples of study area

S. No	pH	EC	TDS	TA	CO_3^{2-}	HCO_3^-	TH	Ca^{2+}	Mg^{2+}	Na^+	K^+	Cl^-	SO_4^{2-}	NO_3^-	F^-
		µS	mg/L												
1	8.7	1246	908	378	ND	368	321	145	105	189	5.1	125	125	22	1.1
2	7.8	1162	980	330	ND	230	363	154	124	168	6.2	121	141	36	0.9
3	8.1	980	701	203	13	290	252	86	85	108	4.2	85	95	25	0.7
4	8.6	904	683	352	ND	352	168	93	79	117	3.3	89	109	19	0.6
5	7.9	1084	874	29s2	ND	362	231	166	126	146	2.1	109	122	24	0.9
6	7.6	984	768	242	6	402	331	102	104	157	4.1	97	119	21	1.0
7	9.1	1324	839	262	ND	362	323	161	112	179	5.3	129	129	32	1.1
8	8.4	1106	732	333	ND	442	218	134	123	198	4.8	118	142	27	1.3
9	8.8	1316	943	408	ND	308	342	101	113	170	5.1	110	132	32	0.8
10	7.9	1092	923	296	5	396	283	171	109	210	3.2	123	125	23	0.9
11	9.6	998	725	249	ND	249	312	161	98	107	5.6	100	84	28	1.1
12	8.8	1046	769	173	ND	276	273	98	89	133	2.8	93	107	31	1.2

pH

pH is a measure of the hydrogen ion concentration to represent the acidic or alkaline nature of water. The standard value of pH for drinking water as per BIS is 6.5-8.5. In the present study all the samples have pH values that were from 7.6-9.6. Some sites have slightly high pH.

Electrical conductivity, EC

The conductance is eBay is the measure of concentration of mineral constituents present in water. It gives a rapid method to get an idea about dissolved solids in water the value depends upon the presence of total concentration of ions low conductivity for less polluted water due to absence of ionic impurities the higher values indicate the largest proportion of inorganic salts conductance results of all the sites where from 904 µS to 132 µS.

Total Dissolved Solid, TDS

TDS is an important indicator to ascertain water quality. It indicates the presence of various salts in water. High content of dissolved solids increases the density of water and influences osmo- regulation of freshwater organisms. The reduced solubility of gases like oxygen and utility of water for drinking, irrigation and industrial purposes. It also causes gastrointestinal problem in humans. The TDs value of the sides under investigation ranges from 683 to 980. It is higher than the prescribed limit of BIS, 500 mg/l.

Total alkalinity, TA

TA is the alkalinity of water. It is acid neutralizing capacity and measure of aggregate property of water and can be expressed in terms of specific substance with known chemical composition. It gives information to decide the mode of treatment of water. The value of TA in the study reason ranges from 173 to 408 mg/l. It is higher than the BIS prescribed limit of 200 mg/l in most of samples.

Carbonates and Bicarbonates

Carbonates and bicarbonates make the water temporarily hard. These are formed due to dissolution of carbon dioxide in water at slightly higher ph. This form scales in pipes and boilers. Carbonates were not detected in sample water but bicarbonates are present in the range of230- 442 mg/l slightly higher as per BIS limit, 400mg/l in some samples.

Total Hardness, TH

The total hardness is defined as the sum of calcium and magnesium concentration. It's value in all water samples is much more 168-363, as that of BIS standard 100mg/l.

Calcium and Magnesium

These are major component of water. The concentration of calcium up to 100mg/l form scales in pipes and boilers. In study region value of calcium ranges from98-171mg/l and that of magnesium from 85-124mg/l. These are higher

values as recommended by BIS, 75mg/l and 30mg/l for calcium and magnesium respectively.

Sodium

It is a major component of portable water. The average level of sodium is 100mg/l. Sodium has medicinal effect on health but large concentration in blood leads to hypertension. Its value ranges from 107-210mg/l in all samples of water.

Potassium

It is not present in high concentration in water the ratio of sodium to potassium is10:1. In the samples of water of study area its value found between 2.1-6.1mg/l.

Chloride

The concentration of chloride where is from sample to sample where is from sample code sample it has no adverse effect on health but it empowers bad taste to drinking water with increase in level of chloride in water corrosiveness of metal also increases in the water sample of the study region its value lies between 85-129mg/l. These values are of higher range as per recommendation of BIS 200mg/l.

Sulphate

Generally found in hard water. It also indicates pollution in water. It is formed by biological oxidation of sulphur compounds sodium. In the Present study its value is higher, 84-142mg/l, in some samples as prescribed by BIS 200mg/l.

Nitrate

The nitrogen in water undergoes oxidation to form ammonia then nitrite and finally nitrate. The nitrogen originates from vegetable material from land run off due to sewage pollution. The synthesis is of protein and amino acids is affected by nitrogen. The high concentration of nitrate in water may cause blue baby disease. The desirable value given by WHO is 40mg/l. In the study region its value was observed between 19-36mg/l.

Fluoride

This is the most important component of drinking water. The level of 1.0mg/l as prescribed by BIS. Within the limits it is good for growth of teeth in children mark if present insight access it may affect nervous system dental decay hand also deposited in bones. In most of the present study samples it is within range,0.6-1.3mg/l. The results of above study revealed that quality of ground water of area near Yamuna River is not good for consumption. All parameters are at higher limits as per BIS standards.

Conclusion

The present study gives an overview that the ground water quality is not of safe category. Most of the parameters are at higher range than the standards of BIS. The reason may be pollution of nearby surface water of Yamuna River, as there is a possibility of internal interaction of surface and ground water at, river bank area specially in pre monsoon season. Therefore, a detailed further investigation and planning must be done to control the pollution of river and nearby area so that safe water can be available for drinking and other purposes.

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