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CHEMICAL ANALYSIS OF UNDERGROUND WATER IN GHAZIABAD REGION

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ABSTRACT

Underground water contamination is a big hazard, all living organism including plants and animals water pollution or water destruction, in which various contaminants unify together to degrade quality and nature of water. This form of environmental degradation occurs due to pollutants which are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds. At some extent natural disasters can be the utmost reasons but not by all the senses. The major ions which are responsible to maintain the quality of ground water includes various cations and anions like: carbonate (CO_3^{2-}), bicarbonate (HCO_3^-), Chloride (Cl^-), Sulphate (SO_4^{--}), Nitrate (NO_3^{--}), Phosphate (PO_4^{3-}), Fluoride (F^-), Ca^{++},Cu^{++}, Mg^{++}, Na^+ and K^+. Among the above briefed ions Ca++ and Mg++ are the ones which are responsible for the hardness of water. Water's hardness is determined by the concentration of multivalent cations in the water. This hard water if consumed by animals or humans can meddle with the normal physiological function of the body. Nine water samples are collected from different locations especially near to the location of the industrial area with limestone works, carbon plant and during summer. The areas include Mohan nagar, Jassipura, Nehru nagar, Gandhi nagar, Raj nagar, Sahibabad, Murad nagar, Lohiya nagar and Modi nagar.

KEYWORDS: Ground water quality, Total alkalinity, Total Hardness, Electrical conductivity.

INTRODUCTION

Ground water is the water present beneath Earth's surface in soil pore spaces and in the fractures of rock formations. Water is a transparent and nearly colorless chemical substance that is the main constituent of Earth's streams, lakes and oceans and crucially required for the survival of

all biotic components.[1] Less than 0.3% of all fresh water is in rivers, lakes, the atmosphere and an even smaller amount of the Earth's (0.003%) is contained within biological bodies and manufactured products. Over 50% of the United States population depends on groundwater for drinking water. Ground water contamination occurs when man-made products such as gasoline, oil, road salts and chemicals get into the ground water and cause it to become unsafe and unfit for human use. Drinking contaminated ground water can have serious health effects. Diseases such as hepatitis and dysentery may be caused by contamination from septic tank waste.[2] Poisoning may be caused by toxins that have leached into well water supplies. Wild life can also be harmed by contaminated groundwater. Other long term effects such as certain types of cancer may also result from exposure to polluted water. Other diseases like for example diarrhoea, cholera, jaundice, amoebiasis, lead poisoning, polymavirus infection and further still undiscovered disorders are the resultant of the water contamination. It is even possible for untreated waste from septic tanks and toxic chemicals from underground storage tanks and leaky landfills to contaminate groundwater. Materials from the land's surface can move through the soil and end up in the groundwater. For example, pesticides and fertilizers can find their way into groundwater supplies over time. Road salt, toxic substances from mining sites, and used motor oil also may seep into groundwater. In addition, it is possible for untreated waste from septic tanks and toxic chemicals from underground storage tanks and leaky landfills to contaminate groundwater.[3]

MATERIAL AND METHOD

Sample collection and preparation

Samples were collected from nine sampling sites of Ghaziabad (UP) regions during March to May 2016. Ground water samples from various water sources like River, Hand-pumps were collected in polyethylene bottles that were soaked overnight in 15% nitric acid. The soaked polyethylene containers were washed with deionized water and dried at room temperature. Afterward, the containers were rinsed several times with the water source to ensure sufficient flushing before collection. These water samples are collected after pumping the water for 10 minutes. All samples were brought to the laboratory in an ice box jar to avoid unusual change in water quality and stored in a refrigerator (4°C) before analysis. The method of collection, preparation and preservation were followed that listed by American Public Health Association (APHA).[4,5]

Experiment

pH value of river water samples under investigation were measured by using Systronic pH meter, type 335. The pH meter was standardized by buffer solution of pH 4 and pH 9.2. Then total alkalinity of the water samples were determined by titrating with N/50 H_2SO_4 using methyl orange indicator. The total hardness of the water samples were determined by complexometric titration with EDTA using Eriochrome black T as an external indicator. The cadmium hardness of the water samples were determined by complexometric titration with EDTA using ammonium purpurate as an indicator. The estimation of chloride ion is generally made by titrating the water solution against the standard solution of silver nitrate using potassium chromate as an indicator. Na^+ & K^+ were estimated using Flame Photometer (128). NO_3^-, SO_4^{--}, F^- were estimated using U.V. Spectrophotometer. TDS is measured by gravimetric method. EC Value under investigation was measured by Systronic E.C. meter. Various parameters were recorded as per requirements.[3] So, Area wise our water analysis and its data recording has been done in the three of the tabular form charts:

RESULT AND DISCUSSION

The pH of water body indicates deterioration of water quality and range of 6.5-8.5 is normally accepted as per the guidelines suggested by WHO.[6] The pH value of collected samples was found of different area ranged from 9.78-11.28 which showed that the pH of water sample was observed to be highly alkaline.[4] Alkaline water is commonly defined as a beverage that has a value greater than 7 on the pH scale and desirable limit for total alkalinity is 200 mg/L. Alkalinity of water has lot to do with human health because there are various parts of the body which can properly work when their would be exact maintenance of the alkalinity level required by them. Many of the unwanted pollutants leach to the soil because of pesticides and thus cause many body disorders.[6] For an instance: Kidney, Gut functions, Cardio vascular dysfunction, metabolic abnormalities and others. The desirable limit for hardness in drinking water according to I.S. is 300 mg/L, whereas its value were varied strongly from 535 – 570 mg/L. Excess amount of calcium leads to the problem of hyper calcemia. Hardening of the water exerts acute effect on the iron absorption. Sewage is also becoming the key source for the influx of unwanted elements. Area where calcium related work is in excess waste water of that areas coming through sewage bring monstrous effect with them.[7] Na^+ content more than 50 ppm makes the water unsuitable for drinking. The Na^+ content for all samples was more than expected. Value of Na+ in examined sample was sort out to be 425-510 mg/L. Sodium salts are easily soluble in the water. Their leaching from the terrestrial level to the underground water level is not an tedious

change to occur.[8] Thus this condition of water leads to problem of the rise of[9] blood pressure in the body[10], arterial hypertension[11] causes nausea, convulsions, muscular twitching, problem of dismaintenance of osmotic pressure, embryotoxicity, teratogenicity, reproductive toxicity and others. Thus it causes the condition of hypernatraemia, within the body.[12] Potassium is an essential element for human with the concern for healthy lives and it occurs widely in the environment, including all natural waters. K^+ value which is an essential nutrient for plant varies from 210 – 220.3 mg/L[30], which in turn can lead to Hyperkalemia and with this various problems in nerve impulse conduction also persist. The adequate intake for adults (19–>70 years of age is 4.7 g/day (IOM, 2004). This is equivalent to 78 mg/kg body weight per day for a 60 kg adult. There are various problems related to the hyperkaelemia like arterial disorders, diabetes, adrenal insufficiency, immature kidney function, hypertension, and coronary artery disease and other. Many of the elements come as a result of percolation from the agricultural grounds.[14] When pesticides or other insecticides are sprayed on this agricultural land, multifaceted ramifications are noticed.[15] Infants also have a limited renal reserve and immature kidney function and may therefore be more vulnerable. Accordingly ingestion of potassium supplements of up to 3700 mg/day is likely to be without overt effects.[16] The chloride value is also more than the acceptable limit as prescribed by WHO and is greater than 5800 mg/L. Thus enhanced level of chlorine leads to urinary bladder and increased chances of rectal bladder cancer, cancer, heart diseases. It really has a negative cosmetic effect on the body, it robs our skin, robs the moisture and the elasticity of the hair.[17] SO_4^{--} More than 200 mg/L are objectionable for domestic purpose. The SO_4^{--}value was also found more than acceptable limit. Its value was found to be280mg/L. Its excess consumption would lead to the cathartic effect on the human body, dehydration[18], laxative effect and others.[19,20,21] Fluoride is essential for human life. According to WHO 1984 and Indian standard drinking water specification 1991 the maximum permissible limit of fluoride in drinking water is 1.5 ppm. Its highest desirable limit is 1.0 ppm. Its Low concentration (approximately 0.5 ppm) helps in preventing dental caries. Fluoride concentrations above 1.5 ppm in drinking water cause dental fluorosis and much higher concentration skeletal fluorosis. Its quantity in the water sample of this area was also found to be excess. The excess quantity may cause some health problems and even higher concentration may cause skeletal fluorosis. Much percentage of people are under the risk of endemic flourosis. Here, Fluoride in river water is very strong as 1.89-3.5 mg.[23] (20)Total solid is considered to be the sum of dissolved solid and suspended solid in water body which consists of inorganic salts and small amount of organic matter.[24] Increase in suspended solids contains much of the organic matter. Increase in suspended solid tends to increase the pollution. An upper limit 500

ppm has been set in order to control undesirable taste and diarrhoea. Different parameters of nine region water samples were shown in Table 1 to Table 3 and Table 4 showed Physical and chemical properties of ground water as per Indian Standard 10500: 2012 and list of substances found in ground water along with their effects.

Table 1: This is showing different parameters of Raj nagar, Nehru nagar and Gandhi nagar.

S. No.	Parameter	Raja nagar	Nehru nagar	Gandhi nagar
1	pH	9.95	8.84	10.12
2	Total; Alkalinity	548	470	540
3	Total Hardness	940	640	770
4	Ca^{++}	660	580	570
5	Mg^{++}	838	830	490
6	Na^{+}	74.5	164.2	610.6
7	K^{+}	359.5	370.5	330.2
8	Cl^{-}	750.56	660.55	655.85
9	$SO4^{--}$	324.1	350	238
10	$NO3^{-}$	1.8	3.6	4.5
11	F^{-}	1.76	3.45	3.1
12	Total Dissolved Solid	2378	2730	3240
13	Electrical Conductivity	980	975	865

All the values are expressed in mg/ltr. Except pH & EC

Table 2: This is showing different parameters of Murad nagar, Sahibabad and Modi nagar.

S. No	Parameter	Murad nagar	Sahibabad	Modi nagar
1	pH	8.82	8.69	8.1
2	Total; Alkalinity	346	476	530
3	Total Hardness	785	876	786
4	Ca^{++}	550	560	510
5	Mg^{++}	231	328	279
6	Na^{+}	66.8	120.8	138.8
7	K^{+}	230.4	240.5	230.8
8	Cl^{-}	575.46	580.75	556.25
9	$SO4^{--}$	242.1	235	231
10	$NO3^{-}$	2.9	5.7	6.5
11	F^{-}	1.88	3.8	4.2
12	Total Dissolved Solid	2458	3780	2380
13	Electrical Conductivity	778	870	1875

All the values are expressed in mg/ltr. Except pH & EC

Table 3: This is showing different parameters of Lohiya nagar, Jassipura and Mohan nagar.

S. No	Parameter	Lohiya nagar	Jassipura	Mohan nagar
1	pH	7.82	8.58	8.9
2	Total; Alkalinity	436	486	430
3	Total Hardness	794	864	776
4	Ca^{++}	556	542	595
5	Mg^{++}	242	332	282
6	Na^{+}	67.8	153.8	148.8
7	K^{+}	238.5	260.5	250.8
8	Cl^{-}	655.97	590.58	756.86
9	$SO4^{--}$	142.1	275	284
10	$NO3^{-}$	2.6	5.8	8.5
11	F^{-}	1.89	7.9	4.2
12	Total Dissolved Solid	2678	2680	2880
13	Electrical Conductivity	774	895	975

All the values are expressed in mg/ltr. Except pH & EC

Table 4: Physical and chemical properties of ground water as per Indian Standard 10500: 2012 and list of substances found in ground water along with their effects[23,16]

S. No	Parameter	Unit	Acceptable Limit	Permissible Limit	Types of Problem
1	Colour	Hazen unit	5	15	-
2	Odour	-	Agreeable	Agreeable	-
3	pH	-	6.5-8.5	No relaxation	-
4	Turbidity	ntu	1	5	-
5	Total dissolved material	mg/l	500	2000	-
6	Ammonia	mg/l	0.5	0.5	Portability, Corrosiveness
7	Boron	mg/l	0.5	1	Corrosiveness
8	Calcium	mg/l	75	200	Encrustation
9	Chloride	mg/l	250	1000	Portability, Corrosiveness
10	Fluoride	mg/l	1	1.5	Fluorosis
11	Magnesium	mg/l	30	100	Encrustation
12	Nitrate	mg/l	45	45	Methemoglobenemia
13	Total alkalinity	mg/l	200	600	Portability, Health aspects
14	Sulphate	mg/l	200	400	Portability
15	Total hardness	mg/l	200	600	-
16	Temperature	^{0}C	-	-	
17	Sodium	mg/l	-	-	Hypertension
18	Iron	mg/l	0.3	0.3	Encrustation, staining of laundry and toilet fixtures
19	Cadmium	mg/l	0.003	-	Portability, Corrosiveness
20	Chromium	mg/l	0.05	0.05	Portability, Corrosiveness
21	Zinc	mg/l	5	15	Portability, Corrosiveness
22	Manganese	mg/l	0.1	0.3	Encrustation, staining of laundry and toilet fixtures
23	Nickel	mg/l	0.02	0.02	Portability, Health aspects
24	Silica	-	-	-	Encrustation

CONCLUSION

In the present study it was found that physico-chemical characteristic of a river water sample cross the maximum permissible limit. Thus, it is concluded that, in general, the underground water quality of these studied area was not satisfactory and unsuitable for human consumption and other domestic use. In real sense repercussions of this water consumption can be detrimental towards all living beings in this area whether human or animal. If it would be continued to be used by the people of the area then it can prove fatal for their health. The body change could be varying from disturbing the reproductive parts as well as other delicate organs such as liver, kidney, heart and other. If people of this area remain continued to drink this water then no doubt their body will acquire the symptoms of many water borne diseases. Thus, every one of us should try more and more to deduct the chances and events of water pollution because it's a premonition for all humans and we can't circumvent this situation. Thus, we need to subjugate this snaring situation.

REFERENCES

1. https://en.wikipedia.org/wiki/Water.
2. www.newhealthadvisor.com/Diseases-Caused-By-Water-Pollution.html.
3. Dohare D, Deshpande S, atul Kotiya A. Analysis of Ground Water Quality Parameters: A Review, Research Journal of Engineering Sciences, 2014; 3(5): 26-31.
4. Amanial HR. Assessment of Physicochemical Quality of Spring Water in Arbaminch, Ethiopia. J Environ Anal Chem., 2: 157.
5. https://medlicker.com/926-alkaline-water-dangers
6. whqlibdoc.who.int/publications/2009/9789241563550_eng.
7. www.nrdc.org/issues/water-pollution
8. http://www.who.int/water_sanitation_health/dwq/chemicals/sodium.
9. Elton NW, Elton WJ, Narzareno JP. Pathology of acute salt poisoning in infants. American journal of clinical pathology, 1963; 39: 252-264.
10. Fatula MI. The frequency of arterial hypertension among persons using water with elevated sodium chloride content. Soviet medicine, 1967; 30: 134-136.
11. Tuthill RW, Calabrese EJ. Drinking water sodium and blood pressure in children: a second look. American journal of public health, 1981; 71: 722-729.
12. US EPA (1999b) Health effects from exposure to high levels of sulfate in drinking water workshop. Washington, DC, US Environmental Protection Agency, Office of Water (EPA 815-R-99-002).

13. http://www.explainthatstuff.com/waterpollution.html
14. Koplin D. Agricultural Chemicals in Iowa's Ground Water, 1982–95. US Geological Survey, 1997.
15. http://www.bioray.com/content/Chlorine.
16. http://www.who.int/water_sanitation_health/dwq/chemicals/sulfate.
17. Chinoy JN. Effects of fluoride on physiology of animals and human beings. Indian J Environ Toxico, 1991; 1: 17–32.
18. Reda AH. Physico-chemical characterization of tannery effluent and its impact on the nearby river. J Environ Chem and Ecotoxicology, 2016, 8: 44-50.
19. P.H. Daniel, "Investing in Tomorrow's Liquid Gold," 19 April 2006. http://finance.yahoo.com/columnist/article/ trenddesk/pp3748
20. Clean Watersheds Needs Survey 2012 Report to Congress, Environmental Protection Agency, January 2016.
21. Chinoy JN. Effects of fluoride on physiology of animals and human beings. Indian J Environ Toxico, 1991; 1: 17–32.
22. https://www.sciencedaily.com/terms/water_pollution.htm
23. Bureau of Indian Standards, New Delhi, IS 10500: 2012.
24. https://medlicker.com/926-alkaline-water-dangers.