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Determination of Fe, Ni, bicarbonate, Pb, Sn, and Cr in drinking water

Abstract

The physicochemical characteristics of drinking water obtained from 10 locations in Moradabad have been tested to determine the quality of drinking water. This paper is about the correlation study of drinking water in various locations of Moradabad. This aims to bring about the value of groundwater quality at the site. Following traditional sampling methods and procedures from the different locations to analysis of different physical and chemical parameters. The findings were compared to Indian WHO and BIS standards. This research revealed that the area's water is heavily contaminated and quality control is urgently needed. Titrimetric analysis have been made for measurement of Fe, Ni, bicarbonate, Pb, Sn, and Cr in drinking water.Measurements have also been carried out on conductivity and pH of these elements/compounds. Total dissolved solids are determined gravimetrically.

Keywords: Water sample, titration, indicator, groundwater, parameters, eriochrome-black T indicator , distilled water.

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Introduction

Water is a substance held capable of prolonging life indefinitely and is one of the most essential resources. It is chief for living organisms, but as the human population has increased, this valued resource is gradually more in danger, raising the demand for more high-quality water for household purposes and commercial operations. It makes up approximately seventy percent of the mass of the body of nearly all living things. About ninety seven percent of the earth's water is saline and nearly 3% is available as clean water from which about twenty percent makes ground water. Groundwater is highly efficient, priced because of certain characteristics that surface water does not have. Water quality relies on the weathering of the parent rocks and chemicals in the anthropogenic activities of the physical and chemical constituents. The studies of quality of Groundwater are more appropriate by reason of human-created operations such as household manufacturing and agricultural

actions. Groundwater pollution occurs mostly in city areas because of household and manufacturing releases. Such practises as the discarding of manure water, diseased tanks and toxic waste. These studies are not necessary when alternate supplies are available. The world's substitute supplies, however are not adequate for the entire population in many areas, especially in city areas.The areas are not available , mainly in Moradabad region . 90 percent of the water supplied to the city and to India, according to the Central Pollution Control Board,Cities are infected, with just 1.6 percent of them being treated. Water quality control, therefore is important to human well-being (Gupta SC. 1991). Often, Total Dissolved Solids is examined in to create an ecosystem of water quality conducive to the growth of the organism. (CO2) Pollution Free Carbon Dioxide occurs naturally in water in different quantities. In drinking water, the majority of the groundwater contains < fifty mg/l of CO2. If we consider H2O, a large amount of CO2 causes acidic H2O conditions. The following happens when CO2 dissolves in water;

Carbonic acid (H_2CO_3)is formed by water (H_2O) plus carbon dioxide (CO_2). Hydrogen (H+) and bicarbonate alkalinity result from the dissociation of carbonic acid . When the concentration of CO2 increases in water, pH value will decrease and, conversely, when the HCO_3^- alkalinity substance raises, it will increase. CO_2 usually includes mineral acids such as H2SO4 or HCl acid in water with a pH of 3.5 or below. Carbon dioxide may occur in H_2O having pH values ranging from 03.6 to 08.4, but it will not exist in waters with pH values of equal to or more than eight point five. The value of pH is not an indicating the quantity of CO2 in the H_2O , but to a certain extent the association between CO2 and alkalinity of Bicarbonate . Different parameters have been correlated with the help of statistical regression . Such type of investigation determines the closeness of the relationship between the chosen different type of self-determining and dependent variables. It is seen to be closer to +1 or -1 when the correlation coefficient is the likelihood of a linear connection between different inconsistents x and y. The purpose of this method analysis is to evaluate the significance of the variable's connection and thus provide a predictive or forecasting context. (Madhuri U et.al 2004, Mulla JG et al.2007, Draper NR,1966).

The correlation coefficient is a valuable method for supporting research on water pollution problems. Till now, effort has not been made yet to consistently expect the groundwater parameters of the concerned region with the help of the correlation coefficient of various types parameters which are used for studying the quality of water.

Over the last few decades, Moradabad has seen quick industrialization and population expansion. The primary business is brassware, steelware, paper mills, sugar mills, crushers, dye manufacturing and a number of associated additional industries. In multiplying the amount of water pollution, most of these factories and various kinds of man working play their part. To provide people with clean water in an efficient way, it is important to undertake a broad study of the parameters of water drank by people. This will aid in improving the water quality.

MATERIAL AND METHODS

In order to measure pH and conductance measurement, a pH meter and a conductivity meter were taken. Titrimetric calculations were made of total hardness, available Cl, CrO_4^{-2}, CO_3^{-2}, Calcium ion, Magnesium ion, dissolved CO_2, alkalinity, Chloride ion, Copper ion, and Zinc ions.

COLLECTING SAMPLE

A total of 10 groundwater samples were collected using standard sampling methods and procedures from Indian Mark II (IM2) hand pumps (Snedeco GW et.al.1967, Kumar J et.al.2005,APHA 1995, Merck E. 1974). After running the water straight from the hand pumps, water samples were collected for around 40 minutes.

ANALYSIS BY MEANS OF TITRATION

With +99 percent purity registered, the salts taken in these experiments were AR grade and without moisture. Ethylene Diammine Tetra Acetic Acid (Aldrich), Potassium iodide from Darmstadt, $Na_2S_2O_3$ (AR), Sodium hydroxide from Fluka, Silver nitrate from SAS Chemicals, Hydrochloric acid and sulfuric acid from Qualikem, all salts were dried by means of a vacuum oven at one twenty degree centigrade for many days before use. By using double-distilled water, stock solutions were prepared for the measurement. The concentrations were obtained using density measurement with the help of a densimeter (vibrating tube) from Anton Paar Co.,Ltd.. Complete hardness was measured and titrated with 0.01M EDTA solution by using (20 CC of water + 5 cc of buffer solution (ammonium chloride +ammonia)+ few drops of the indicator(Eriochrome black-T). The solution switches from deep red wine to blue at the end stage. In order to determine Cl_2 ,water sample with CH_3COOH and potassium iodide solution is taken , which is titrated against 0.01 M $Na_2S_2O_3$ solution until the color is yellow. Now the blue colour is obtained after adding starch solution, the entire substance is titrated again with the regular 0.01 M $Na_2S_2O_3$ until the disappearance of blue colour . Water sample + 3-4ml H2SO4+ 0.5gm NaHCO3+2gm potassium iodide is taken for chromate estimation in drinking water, which is titrated against

0.01 M Na2S2O3 solution. At the end point the color is yellow. Now after applying the starch solution, blue color is seen, the entire mixture is titrated against $Na_2S_2O_3$ again, blue color diminishes at end point. Water sample is collected in a beaker for CO_3^{--2} estimation, few drops of MO indicator added and Titration is done against 0.01M Hydrochloric acid, the colour varies from yellow to red at last. Gravimetric processes for calculating TDS is used which includes the liquid solvent being evaporated and the mass of remains remaining being weighed. In general, this approach is the safest, even though it takes time. In case the salts of inorganic compounds form the greater part of total Dissolved solids, gravimetrical analysis are suitable. Water sample is combined with few drops of suitable indicator and titrated against NaOH (0.02N) for the measurement of dissolved carbon dioxide. In order to measure Ca, in the presence of few drops of EBT indicator , water sample along with Buffer solution (ammonium chloride +ammonia) and titrated against O.01M ethylene diammine teraacetic acid .To determine the full alkalinity of fresh water, titration is done with 0.02N sulfuric acid standard solution with few drops of MO indicator. For chloride ion determination, water sample with few drops of fluorescein indicator is taken in a conical flask and titrated against with 0.001M Silver nitrate solution . At the end stage, the AgCl coagulates noticeably, and the precipitate immediately takes on a pinkish colour. To detect Cu, water sample is taken, added 3-6ml of ammonia to obtain pH equal to six to thirteen, then added few drops of Murexide Now titrated with 0.001 M ethylene diammine teraacetic acid solutions. At the end point colour changes to blueish violet.

For estimation of Zinc, water mixed with 2 ml buffer (pH=10) and few drops of EBT indicator .Titrated with 0.001 M ethylene diammine teraacetic acid solution. Colour changes to blue at the end stage.

During correlation, a one +Ve (increasing) linear relationship (correlation) indicates the degree of linear dependence between the variables, −1 in the case of a perfect decrease (-Ve) and between −1 and 1. The nearest the coefficient is to either -1 or 1, the greater the variables' association is.

Strength calculation

After molarity was obtained by titration method, the strength calculation of element or compound was done with the help of following relation:

Strength = M x molecular weight of element or compound

Where M=Molarity

Results and discussion

For different ions, elements or compounds, the results obtained are given in Table 1 and 2.For groundwater samples, the different physicochemical property values were judged against with the Bureau of Indian Standard and World Health Organization parameters in Table 3.

As per the procedure mentioned above, correlation analysis for the groundwater samples was performed. For TH-Cl_2 (r=0.5368), The values of the correlation coefficient are positive, suggesting mild correlation.

The r value is positive for alkalinity-chloride ion(r=0.5555), suggesting a mild correlation, indicating that low y variable scores tend to go for high x variable scores. For Ca-Mg ions, the r=0.1693 value is logically connected with +ve, but the variable relationship is weak. We obtain The positive and too low value of r for EC-Magnisium ions (r= 0.0045), while the variable relation is theoretically small + ve correlation. In case of Alkalinity-Chromate the value of r is equal to 0.213, the vector relationship is also small.

Conclusion

We have concluded from the above results that the quality of drinking water declines due to increased industrialization, and therefore adequate water analysis and prior care are needed.This research revealed that the area's water is heavily contaminated and quality control is urgently needed. It is important to research the quality of water consumed by individuals in order to provide people with clean water in an efficient way. this will aid in improving the water quality. The stored water had physic-chemical constituents within Ghana standards/ WHO guidelines values and therefore not suitable for potable use. Easy water treatment techniques at home, such as chlorination, filters, solar disinfection, etc. Researches on water quality parameters are consistently required in the world because much disease occurs due to impure water.

TABLE 1: Properties* OF water samples taken from various places

Sample water taken from	pH	Electrical conductivity	Total dissolved solids	Total hardness	Chlorine	Chromate ion, CrO_4^{-2}
Amroha	6.92	0.69	467.8	127	4.6	0.001
Rampur	6.99	0.73	381.67	126	4.4	0.002
Mandi Chowk	7.68	0.69	466.01	120	4.7	0.002
IFTM	6.92	0.69	345.94	124	9.0	0.0011
Budh Bazar	6.99	0.54	297.86	116	8.8	0.0014
Katghar	7.68	0.39	178.85	112	6.4	0.0016
Kanth	7.98	0.41	428.63	122	9.0	0.0017
TMU	8.11	0.39	43.15	116	8.8	0.0011
Pili Kothi	8.09	0.41	189.03	112	6.4	0.0014
Civil Line	8.09	0.25	302.89	122	5.8	0.0016

*UNITS are in mg/l excluding CONDUCTIVITY microsiemen per centimeter and pH.

TABLE 2: Properties* OF water samples taken from various places

SAMPLING STATION	CO_2	Ca^{2+}	Mg^{2+}	ALKALINITY	Cl^-	Cu^{+2}	Zn^{+2}
Amroha	8.12	72.86	17.2	267	11.87	2.4	2.7
Rampur	9.84	69.24	14.2	287	22.62	2.5	1.9
Mandi Chowk	12.2	66.42	23.4	256	16.91	3.1	1.4
IFTM	8.12	64.79	21.3	287	17.81	1.7	2.7
Budh Bazar	8.856	24.45	15.7	297	16.53	1.8	1.9
Katghar	11.1	42.63	13.4	343	45.62	2.2	1.4
Kanth	7.22	54.85	10.8	323	44.97	0.8	2.7
TMU	9.54	31.51	15.5	267	34.13	0.7	1.9
Pili Kothi	11.2	49.47	16.9	287	14.12	0.6	1.4
Civil Line	10.4	53.17	19.4	299	17.30	0.9	2.2

*units in mg/l

Table 3: Comparing of results of GROUNDWATER QUALITY PARAMETERS WITH intake WATER QUALITY necessities With literature values (BIS 1991, WHO 1984)

PARAMETERS	**Samples limit**	BIS STANDARD		**WHO LIMIT(mg/l)**
		Acceptable	Maximum	
	Minimum Maximum			
TOTAL HARDNESS	117 122	299	599	101
TDS	165 489	499	1999	499
CHLORINE	0.3 2.1	0.21	----	----
CHROMATE AS HEXAVALENT ION	0.002 0.0018	0.101	1.0	0.045
CALCIUM	18.78 75.87	75.01	199	74
MAGNESIUM	11.2 26	31	100	150
CARBON DIOXIDE	3.12 11	--	--	--
ALKALINITY	266 299	199	599	-----
CHLORIDE	12 58	249	999	249
COPPER	0.5 04.6			
ZINC	1.6 3.45	5.001	14.999	**1.999**
PH	7.33 8.19	6.49-8.37	9.31	6.49-9.31
CONDUCTIVITY*	0.31 0.78	299	---	-----

*UNITS for CONDUCTIVITY $\mu S.CM^{-1}$

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