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ASSESSMENT OF GROUND WATER QUALITY IN KOKRAJHAR DISTRICT OF BODOLAND TERRITORIAL COUNCIL, ASSAM, INDIA

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ABSTRACT

Water is an extremely important natural resource, essential for sustaining life on Earth. Kokrajhar district of Bodoland Territorial Council (BTC), Assam as a whole is economically backward and the large majority of people belonging to scheduled tribes do not have access to amenities of modern life including a safe supply of water. They depend on all forms of water sources for their needs. In this work, 36 ground water samples of the district, collected from different locations in three seasons of pre-monsoon, monsoon and post-monsoon were analyzed for the drinking water quality parameters. The values of pH, conductivity, turbidity, total dissolved solids, hardness, bicarbonate, chloride, sulphate, nitrate, phosphate, fluoride, Ca, Mg, Na, K, Fe and As, show that the groundwater is not completely safe. The water is characterized by very high iron content in excess of the maximum prescribed limit of World Health Organization. However, most of the water samples did not have high concentrations of the toxic contaminants, fluoride and arsenic. In absence of any type of industrial activities in the district, the water does not indicate chemical contamination of major significance, but causes of concern still exist.

Key words: Groundwater, Ring wells, Water pollution, Water quality, Bodoland.

INTRODUCTION

The quality of water is of vital concern for mankind as it is directly linked with human welfare. For drinking purpose water must be free from organisms and other chemical substances, which are harmful to us. But the drinking water must contain the minerals in balanced condition. A complete systematic analysis can only say about the quality of water. Ground waters from shallow origin are particularly susceptible to contamination from a combination of point and diffuse sources[1-2]. The composition of groundwater has been affected by human activities through changes in land use and intervention in natural flow

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patterns[3]. The quality of water also depends on agricultural land use pattern[4-6]. Due to increase in population, uses of chemical fertilizers, pesticides, industrialization and many other anthropogenic factors, the water from various sources becoming polluted to a larger extent day by day. Animal and human excrement is also a dangerous cause for water pollution in the under developed countries. Consumption of polluted water directly from the sources may cause waterborne diseases like diarrhea, dysentery, typhoid and paratyphoid fever, hepatitis, gastroenteritis, liver and intestinal infection, skin rash, etc. Chemical contamination of drinking water may not cause immediate health problem, but their long time intake may be fatal for human health. The present study has been confined to Kokrajhar district of Bodoland Territorial Council (BTC), Assam, India (Fig. 1). The district spreads over an area of 3165.44 sq Km with a population of 842805 (Census, 2001) dominated by the Bodo tribe[7]. The district is bounded by $26^{o}2^{/}$ N to $26^{o}52^{/}$ N latitude and $89^{o}42^{/}$ E to $90^{o}44^{/}$ E longitude. The area enjoys comparatively mild subtropical climate with a dry pre-monsoon from February to May, wet and hot monsoon from June to October and cool, foggy winter from November to January.

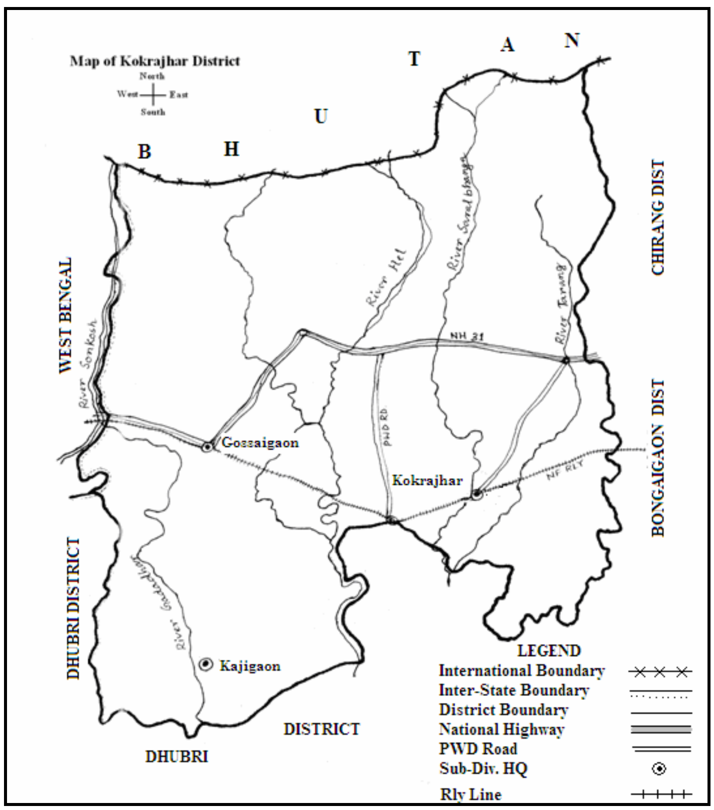

Fig. 1: Map of Kokrajhar District

EXPERIMENTAL

Materials and methodology

36 water samples from most used 12 ring wells (RW) were collected from different parts of the district (Table 1). The water samples were collected by random sampling technique and these were then analyzed for pH, conductivity, turbidity, total dissolved solids, hardness, bicarbonate, chloride, sulphate, nitrate, phosphate, fluoride, Ca, Mg, Na, K, Fe and As.

Table 1: Selected sampling stations

Well	Location name	Diameter (m)	Depth (m)
1	Srirumpur	1.25	6.10
2	Gossaigaon	1.25	6.75
3	Dotoma	1.50	9.50
4	Fakiragram	1.25	8.25
5	Kashibari	1.00	6.00
6	Kokrajhar town	1.50	9.50
7	Bidhanpally	1.25	7.00
8	Bethagaon	1.25	7.50
9	Charaikhola	1.25	12.15
10	Salekati	1.25	9.50
11	Titaguri	1.00	6.50
12	Kadamtal	1.25	6.50

The sampling seasons were pre-monsoon, monsoon and post- monsoon. The samples were collected in pre-cleaned polythene jars of 2 liters capacity. Collection, preservation and analysis of the samples were carried out according to Standard Methods[8] using standard laboratory equipments (Hitachi 3210 UV-visible spectrophotometer, Perkin-Elmer A Analyst 200 Atomic Absorption Spectrophotometer, Elico CL 361 Flame Photometer etc.).

RESULTS AND DISCUSSION

The water samples collected from the study area were found colourless and odourless. Station wise variation of minimum, maximum and mean values of pH values are shown in Fig 2. The pH values of the samples varied from slightly acidic to slightly alkaline. The minimum and maximum values of pH obtained are 6.2 (well 1, 2, 7 and 10) and 8.1 (well 4) respectively. WHO (2004)[9] permissible limit of pH value is 6.5-8.5. Higher values of conductivity of the sample indicate the presence of substantial amounts of ionic components. This confirms the presence of higher TDS, chloride and iron content. The values of electrical conductivity lie between 40 (well 9) to 398 µS/cm (well 2). The range of turbidity lies between 3 (well 6, 9) to 30 NTU (well 10). The range of TDS values lie between 28 (well 9) to 404 mg/L (well 2). The highest value of TDS obtained in the ring well water of Gossaigaon. The high value may be due to soil origin and may also be due to the addition of lime and other chemicals into the well from time to time for water treatment. Excess TDS value imports physiological effects and unpalatable mineral taste in water and have corrosive properly. WHO[9] maximum allowable value of TDS is 1000 mg/L. Total hardness lies between 10 (well 10, 12) to 155 mg/L (well 12). WHO[9] permissible limit is 500 mg/L. The concentration of bicarbonate is directly linked with the alkalinity of water sample.

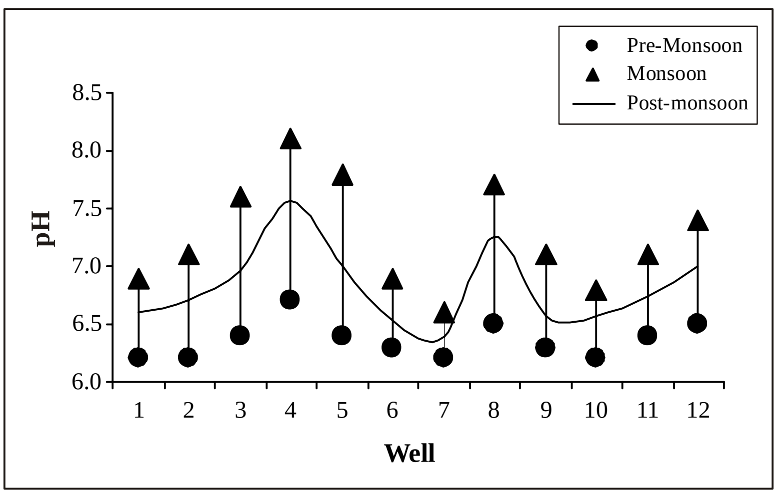

Fig. 2: Station wise variation of pH

The minimum and maximum values of bicarbonate concentration obtained are 15.0 (well 9) to 171.5 mg/L (well 2). The most important source of chlorides in the water is the discharge of domestic sewage. Man and other animal excrete provides very high quantities of chlorides together with nitrogenous compounds. The values of chloride concentration were found within 10.7 (well 5, 9, 10 and 11) to 60.3 mg/L (well 3, 11). In water of Titaguri (well 11) the minimum (10.7 mg/L) and maximum (60.3 mg/L) values were obtained in monsoon and pre-monsoon season, respectively. The value of sulphate lies below detectable level, BDL (well 9) to 44.5 mg/L (well 2). Sulphate produces an objectionable taste at 300 to 400 mg/L concentration and it also has toxic effect to human health. The range of nitrate lie 0.2 (well 5, 8) to 22 mg/L (well 2). During the rainy season the level of NO_3^- tends to go up. Nitrate can cause health problems in infants and animals, as well as the eutrophication of water bodies[10]. A limit of 50 mg/L for NO_3^- has been fixed for drinking water by WHO[9]. The phosphate lies between BDL (well 5, 6, 7, 9, 10) to 0.52 mg/L (well 11). In 40% sampling stations of the study area the concentration of fluoride found below detectable level. The maximum value of fluoride obtained in ring well of Gossaigaon (0.08, mg/L) which is less than the WHO[9] permissible limit (1.0 mg/L). Fluoride is beneficial in small amounts, but causes dental fluorosis if present in excess of 1.0 mg/L and skeletal fluorosis beyond 3.0 mg/L.

Calcium and magnesium concentration of all the sampling stations were within the WHO[9] permissible limit (100 and 150 mg/L respectively). The total hardness of a sample can be calculated by adding the calcium hardness and magnesium hardness. Calcium is an important nutrient for human health but in balanced amount. High calcium content in drinking water may increase the chances of having gall bladder stone. The concentration of sodium of the collected water samples lie between 0.6 (well 9) to 27.7 mg/L (well 12) and that of potassium is 0.2 (well 11) to 13.4 mg/L (well 2). Higher concentration of sodium may be fatal for patient with high blood pressure. Higher concentration of it also causes bitter taste in water and is health hazardous to cardiac and kidney patients. Potassium, a plant nutrient does not have any record of causing harmful effects on human. Most of the samples were having iron content above the WHO[9] permissible limit (0.3 mg/L). Iron is important for life as an integral part of heamoglobin and the oxygen transport system. Excessive consumption may be toxic to cells as it catalyses the production of hydroxyl radical. Iron in higher concentrations may also cause vomiting. Again its deficiency causes anaemia and shortness of breath. The variation of minimum, maximum and mean values of iron is shown in Fig 3.

Concentration of arsenic was found below detectable level to 6.59 µg/L. The maximum value (6.59 µg/L) obtained in the tube well water of Gossaigaon, which is less than WHO[9] permissible limit (10 µg/L). Arsenic contamination in water may take place due to alluvial aquifer, or use of pesticides and insecticides in the agricultural activity. It is highly toxic and possibly carcinogenic. Arsenic exposure causes various vascular diseases, cancer (skin, liver, kidney, lung etc.), hyper tension etc.

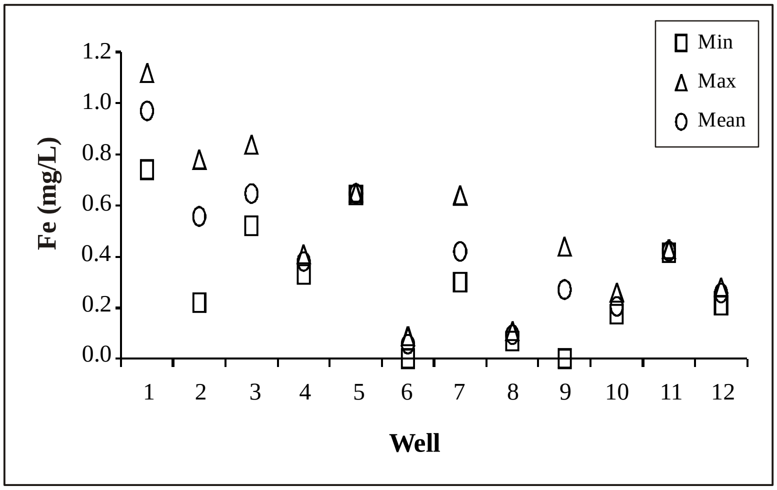

Fig. 3: Stationwise variation of iron content

CONCLUSION

From the above study, it is observed that values of most the parameters are within the WHO permissible limit. Minimum values of pH of some of the samples lie below the lower level of WHO permissible limit (6.5). Although fluoride and arsenic contents are low in most of the sources, a few sources have appreciable amounts and continuous use of the water may lead to their accumulation producing long-term affects. The groundwater is very rich in iron (> 0.3 mg/L) and is not suitable for drinking. Besides, the water is also not suitable for laundering, etc. So many factors like the absence of scientific drainage system, poor sanitary system, presence of stagnant water, unhygienic conditions, etc., are causing water quality degradation and these causes have to be eliminated to maintain the quality of water and get relief from the fatal diseases.

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