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RELATIVE CONTENTS OF CHLORIDE AND SULPHATE IN DRINKING WATER SAMPLES IN DIFFERENT LOCALITIES OF DHAKUAKHANA SUB-DIVISION OF LAKHIMPUR DISTRICT OF ASSAM

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ABSTRACT

The present investigation has been undertaken to compare the chloride and sulphate contents in drinking water samples of the study area. Thirty water samples were analysed during April-June 2008 for pH, total hardness, chloride and sulphate contents by adopting standard methods (APHA-AWWA-WPCF, 1995). The data obtained were within the standard, the permissible limits of WHO. The chloride contents of the water of the tube wells were much less in comparison to other sources. The rivers contains higher amount of chloride. The sulphate concentrations were higher than the corresponding chloride contents in case of the tube wells and ring wells, but the trend was reversed in case of rivers.

Key words : pH, Hardness, Chloride, Sulphate

INTRODUCTION

Water is essential for all living things. Without water, life of any kind is not possible. For human beings living in a civilized society, water is needed in every walk of life. Man needs water for drinking, cooking, washing, bathing, gardening, irrigation, industry and for a lot of other purposes. The quality of water used by man may vary from purpose to purpose. Contamination of drinking water, either directly or indirectly by sewage and other waste or by human and animal excrement is the most common and wide spread danger associated with drinking water quality problems, particularly in the under developed world. Chlorinated solvents are linked to reproduction disorders and to some

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cancers. Chlorides occur naturally in all types of water. The most important source of chlorides in the water is the discharge of domestic sewage. Man and other animal excrete very high quantities of chlorides together with nitrogenous compounds. Contamination of drinking water by sodium chloride and bleaching powder has become an area of much concern.

Sulphates enter natural water through wastes. Atmospheric SO_2 formed by combustion of fossil fuels and emitted from metallurgical processes can also be transferred to water systems through precipitation. Excessive sulphate content has a cathartic effect on humans resulting in purgation of the alimentary canal. It may also lead to corrosion of metals in the distribution system, particularly when the water has low alkalinity. Water pollution studies in India have received tremendous momentum in recent times. Most studies are however, related to rivers[1]. The quality of drinking water of Darrang district of Assam with respect to fluoride and nitrate content in some locations has been studied[2]. Chemical quality of drinking water in the tea garden belt of Lakhimpur district, Assam was also studied[3]. Buragohain et al.[4] studied drinking water quality in the district head quarters of Dhemaji district. There is no earlier data available for various drinking water quality parameters in Dhakuakhana sub-division of Lakhimpur district of Assam, India. The present work has been undertaken with view to further strengthen the data based on drinking water quality so that concerted strategies can be adopted at the planning level to keep the contamination of water bodies at the minimum.

EXPERIMENTAL

Materials and methodology

The need for careful sampling techniques varies according to the constituent being tested. Separate water samples were selected by random selection and compiled together in plastic bottles to set a representative sample. Samples were protected from direct sun light during transportation. Standard methods (APHA-AWWA-WPCF, 1995)[5] were followed during the analysis of pH and total hardness in water. Chloride was estimated by the silver nitrate method. Sulphate was estimated by the turbidimetric method (Systronics Nephelo-turbidimeter, Model 131). The results were evaluated in accordance with the WHO standards[6].

Study area

The study area Dhakuakhana (Fig. 1) is one of the two sub-divisions of Lakhimpur District, which is situated in the eastern parts of India on the North-East corner of Assam.

Located between the latitudes of $27^0$00'(N) and $27^0$18'(N) and the longitude of $94^0$13'(E) and $94^0$32'(E).

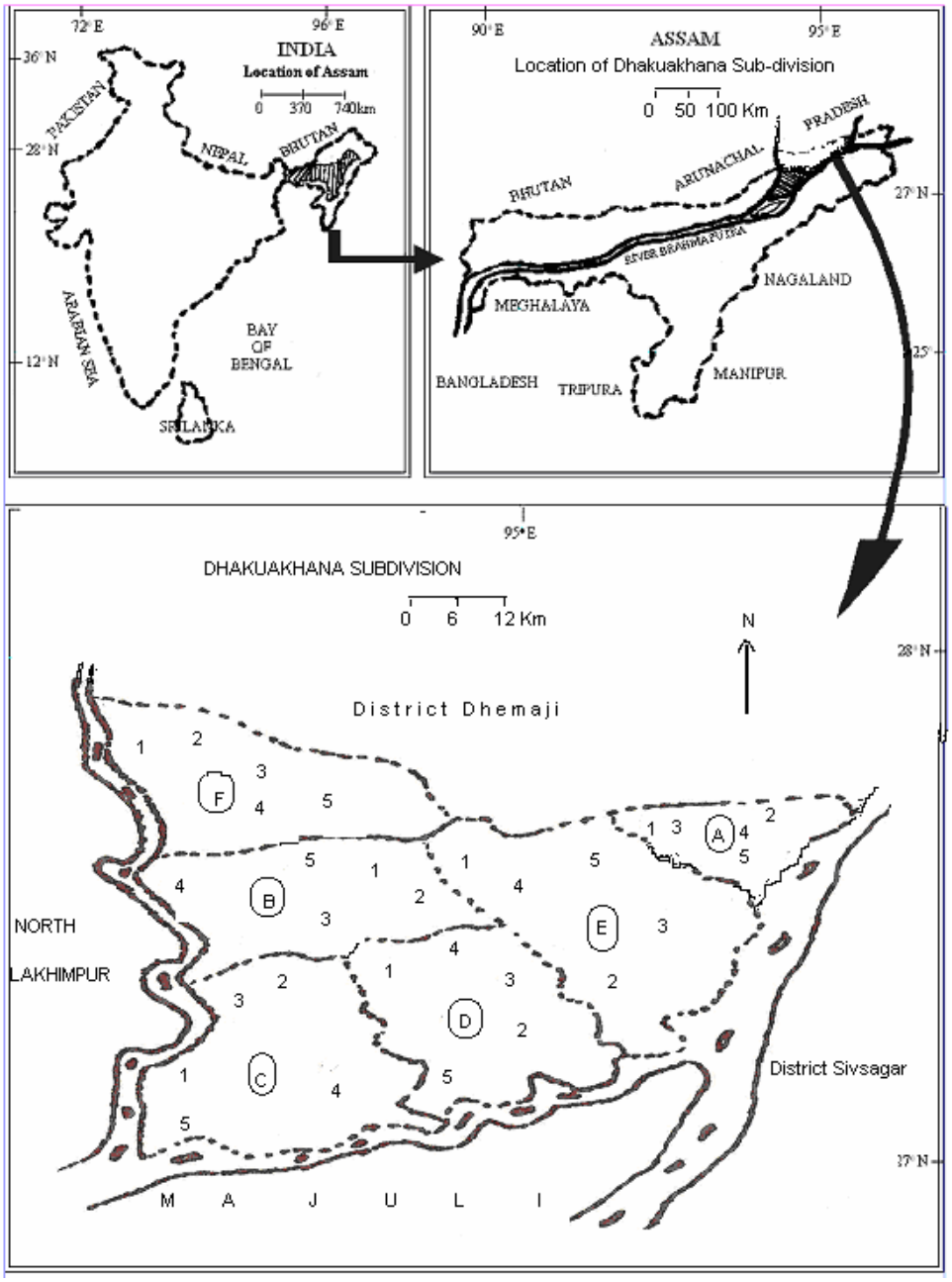

Fig. 1: Location of sampling stations in Dhakuakhana sub-division

RESULTS AND DISCUSSION

Table 1: Water sampling locations

Name of the gaon panchayat	Sample No.	Total number of samples
Harhi	A1 - A5	05
Dhakuakhana	B1 - B5	05
Subansiri	C1 - C5	05
Deolia	D1 - D5	05
Ghilamara	E1 - E5	05
Bordoibam	F1 - F5	05

Table 2 : Water test values in Harhi gaon panchayat :

Sample No	pH	Total Hardness (mg/L)	Chloride (mg/L)	Sulphate (mg/L)
A-1 (TW)	6.5	65.0	2.1	16.0
A-2 (TW)	6.3	69.0	4.8	46.0
A-3 (RW)	6.7	94.0	20.0	30.0
A-4 (TW)	6.6	34.0	4.5	30.0
A-5 (RW)	6.6	77.0	22.0	48.0

(**Locations** : A-1 : Laokuth, A-2 : Gobinpur, A-3 : Modarguri, A-4 : Deoliagaon, A-5 : Panigaon), TW = Tube well, RW = Ring well

Table 3 : Water test values in Dhakuakhana gaon panchayat

Sample No	pH	Total hardness (mg/L)	Chloride (mg/L)	Sulphate (mg/L)
B-1 (TW)	6.7	73.0	02.3	90.0
B-2 (R)	6.4	76.0	90.0	48.0
B-3 (TW)	6.6	55.0	01.8	83.0
B-4 (TW)	6.3	67.0	10.0	32.0
B-5 (TW)	6.8	65.0	02.0	36.0

(**Locations** : B-1 : Dhakuakhana Chariali, B-2 : Charikoria noi, B-3 : Brahmin gaon, B-4 : No. 1-Bantow, B -5 : Bagisa gaon), R = River, TW = Tube well

Table 4 : Water test values in Subansiri gaon panchayat

Sample No.	pH	Total hardness (mg/L)	Chloride (mg/L)	Sulphate (mg/l)
C-1 (TW)	6.6	77.0	05.6	28.0
C-2 (RW)	6.6	79.0	32.0	48.0
C-3 (TW)	6.4	39.0	04.8	48.0
C-4 (RW)	6.5	64.0	24.0	70.0
C-5 (RW)	6.4	28.0	22.0	42.0

(Locations : C-1 : Kath gaon, C-2 : Sunari Sapari, C-3 : Kekuri, C-4 : Bahpara, C-5 : Mor-Noi), TW = Tube well, RW = Ring well.

Table 5 : Water test values in Deolia gaon panchayat

Sample No.	pH	Total hardness (mg/L)	Chloride (mg/L)	Sulphate (mg/L)
D-1(TW)	6.8	68.0	05.6	80.0
D-2 (RW)	6.6	71.0	30.0	50.0
D-3 (TW)	6.4	65.0	06.7	60.0
D-4 (RW)	6.4	37.0	20.0	80.0
D-5 (TW)	6.7	40.0	06.6	58.0

(Locations : D-1 : Phukan gaon, D-2 : Bhakatgaon, D-3 : Lamugaon, D-4 : Sakuli, D-5 : Tamuli gaon), TW = Tube well, RW = Ring well.

Table 6 : Water test values in Ghilamara gaon panchayat

Sample No.	pH	Total hardness (mg/L)	Chloride (mg/L)	Sulphate (mg/L)
E-1(TW)	6.6	51.0	06.0	54.0
E-2 (RW)	6.8	55.0	38.0	60.0
E-3 (TW)	6.5	62.0	06.4	32.0
E-4 (RW)	6.8	72.0	39.0	48.0
E-5 (RW)	6.7	69.0	41.0	69.0

(**Locations** : E-1 : Ghilamara Tiniali, E-2 : Kalita gaon, E-3 : Raidangia gaon, E-4 : Ghahi gaon, E-5 : Milan Nagar), TW = Tube well, RW = Ring well.

The pH is an important water quality parameter measuring the acid-base equilibrium of the dissolved components. In natural waters, the pH is controlled by the carbon dioxide- bicarbonate – carbonate equilibrium and generally the values lie in the

range 6.5 to 8.5. Low pH causes corrosion in the distribution system and increases the metal contamination of drinking water. High pH levels may impart a bitter taste to the water. In most of the cases, the values were within the WHO guideline values for safe drinking water and it was towards the acidic side with a narrow variation.

Table 7 : Water test values in Bordoibam gaon panchayat

Sample No.	pH	Total hardness (mg/L)	Chloride (mg/L)	Sulphate (mg/L)
F-1(TW)	6.4	35.0	02.9	36.0
F-2 (RW)	6.3	64.0	40.0	54.0
F-3 (R)	6.4	71.0	67.0	24.0
F-4 (TW)	6.3	79.0	02.0	37.0
F-5 (RW)	6.5	71.0	30.0	50.0

(**Locations** : F-1 : Chinai gaon, F-2 : Gohain gaon, F-3 : Sampora noi, F-4 : Mohbal gaon, F-5 : Dighali gaon), TW = Tube well, RW = Ring well, R = River.

Hard water is not a health hazard, but dealing with hard water in the home can be a nuisance. When hardness exceeds 180 mg/L, it generally causes problems and a water softener should be considered. However, water softened to zero hardness is corrosive. The water hardness of the study area ranged from 28.0 mg/L to 94.0 mg/L, which were found to be within the permissible limit prescribed by W. H. O (250 mg/L) for potability purposes.

Chloride is a common constituent of all natural waters and is generally not classified as a harmful constituent. The sources of chloride in natural waters are dissolution of salt deposits, discharges of effluents from chemical industries, sewage discharges, irrigation drainage, contamination from refuge dump leaches etc. Natural source of water contains < 10 mg/L of chloride and a content of < 250 mg/L is recommended as the guide line value. Concentration in excess of this can damage pipes and structures and can inhibit plant growth. The chloride contents of the water of the tube wells were much less in comparison to other sources. The rivers contains higher amount of chloride; highest value i. e. 90.0 mg/L was observed in sampling point B-2 (river, Charikoria). In the present

investigation, the chloride contents of the water samples does not exceed the WHO guide line value of 250 mg/L. On the basis of high chloride content (90.0 mg/L), the water of the river studied here may be termed as brackish.

The values of sulphate concentration lie between 16.0 to 90.0 mg/L.

The sulphate concentrations were higher than the corresponding chloride contents in case of the tube wells and ring wells, but the trend was reversed in case of rivers

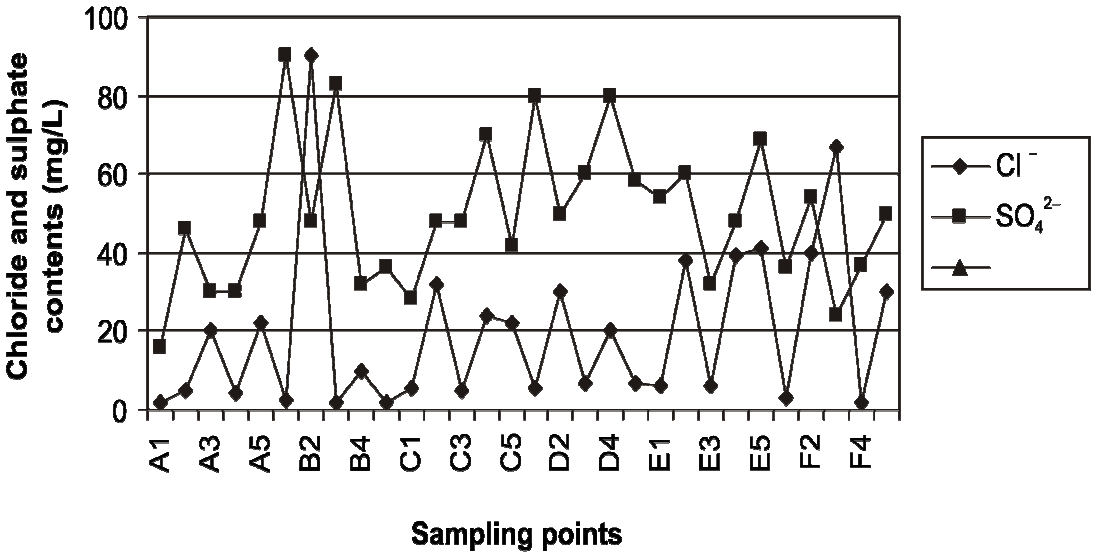

Fig. 2: Relative contents of chloride and sulphate

This is likely to be due to the inflow of chloride rich waste water into rivers while the same is not possible for tube wells and ring wells. On the other hand, high sulphate levels in tube well and ring well waters is perhaps due to –

(i) Most of the sulphates are soluble in water and as such, it is not precipitated. These are used for purification of water e.g. Potash alum. The sulphates are thus likely to be accumulated in ground water.

(ii) Biological oxidation of reduced sulphur species to sulphate may occur in ground water.

(iii) The accumulation of soluble salts in soils and shallow aquifers is a well known phenomenon.

Sulphate produces an objectionable taste at 300 to 400 mg/L concentration and it also has laxative effect on human beings. The ICMR recommends 200 mg/L sulphate as the highest desirable limit in water. None of the water sources in the present study has a sulphate content approaching this limit.

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