Studies on concentration of Arsenic (III) and Chromium (VI) in ground water resources of Naugachia region

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Abstract:-The Koshi river flows North to the Naugachia subdivision of Bhagalpur district. Some Villages of the subdivision remain submerged in water during July to September. Owing to channelisation of flood water with ground water of the region, the ground water becomes contaminated with Arsenic, chromium and some other toxic elements. The ingestion of Arsenic contaminated water more than 0.05 ppm causes skin lesion and on taking higher doses Arsenic contaminated water, it may lead to hyper pigmentation. Hexavalent chromium may cause liver cancer. During study of ground water samples, some of the samples have been found to contain Arsenic more than permissible limit. Some samples have also been found to contain hexavalent chromium more than permissible limit.

Keywords:- Arsenic, Chromium, Groundwater, Hyperpigmenation.

Introduction:- The Koshi river flows North to the Naugachia and joins to the Ganges river in Kursela. Naugachia is a subdivision head quarter situated between two rivers, the Koshi and Ganges. One Vikramshila Setu connects Naugachia from Bhagalpur. It is around 18 Kilometers from the northern bank of the Ganges river. A number of villages of the subdivision face perennial flood due to which crops get damaged and alluvial soil get deposited in the upper part of the soil. The rural population of this area face the problem of potable water during flood. The ground water becomes contaminated with nitrate, Arsenic and other toxic metals.

Nitrates in drinking water come mainly through leaching of the water through the soil. Farmers of this region use nitrogeneous and phosphatic fertilizer for increasing agricultural production especially wheat. Fertilizers are also used in banana cultivation. The use of excess nitrogeneous fertilizer in soil give rise to nitrate concentration in ground water. Blue baby syndrome has been visualized in babies due to the use of nitrate contaminated drinking water. As per the standard of drinking water, permissible limit for nitrate content is 45 mg per litre. Nitrate has been found more than permissible limit in some of ground water samples near agricultural field.

Arsenic, a common constituent of many minerals and rock, has drawn the attention of scientists world over. Arsenic can not be seen, tested or smelled when it is in water[1]. Observation indicate that arsenic is present more than permissible limit in the Gangetic plain at many places though arsenic minerals that give rise to arsenic pollution are rare or even absent in the sediments of the Gangetic delta.[2-4]

As per one estimate almost one third of the country population is potentially exposed to arsenic contamination. In early state, it can not be detected but at later stage hyperpigmentation appears. Chronic exposure to arsenic contaminated drinking water may cause skin lesion, liver and renal deficiencies and cancer in severe cases.

Work has been started with a view to know the arsenic contamination in ground water of the Doab land of Naugachia situated between the Koshi and the Ganges. Several people near the southern bank of the Ganges have been found to suffer from arsenicosis where as near the northern bank no visible symptoms of arsenicosis has been found as yet.

The arsenic contamination in ground water beyond permissible limit of 0.05 mg/L has been found within the shallow aquifer (20-60m below ground level). The source of arsenic in ground water can be traced out by establishing the relations between the river system, the area from where the rivers brought sediments is parent materials. The problem of ground water pollution by arsenic is found in the inter fluvial region of the Bhagirathi – Hugli or Ganga-meghna-Brahmaputra plain.

One of the reasons of the source of arsenic is considered to be the arsenic rich sediments transported from Chotanagpur Rajmahal Highlands. It is clear that the source of the arsenic in ground water is natural and arises because the water flows through arsenic-rich sediments. The exact mechanism by which arsenic is transferred into water is not yet fully explained.

Arsenite (+3) and arsenate (+5) are the most toxic forms of inorganic arsenic that are found in ground water. As (+3) in reduced state in inorganic is a toxic pollutant in natural environment and is more soluble and mobile in comparison to the oxidized state of inorganic arsenic, arsenate As (+5).

It is worth mentioning that Arsenic is one of the less abundant metalloids forming the earth's crust. Its important physico-chemical characteristic is that it is commonly concentrated in sulphide bearing mineral deposits, pyrites and hydrous iron oxides.

In Narayanpur block of this subdivision, some villages have been identified for arsenic contamination.

Experimental

The samples have been collected from different parts of the Diara landnear the Koshi in the month of October. The samples have been analysed by merckoquant arsenic kit available in the laboratory and later on accurately done by Atomic absorption spectrophotometer. The results from merckoquant kit are in agreement with A.A.S.

Results and Discussion

Table 1 shows that samples S1, S4, S5, and S6, of Kadwa Panchayat area are arsenic contaminated

Table 1 : Arsenic contamination in ground water samples of Naugachia Kadwa Panchayat.

Sample numbers	Distance from the Koshi river	Depth. Of tube well	Arsenic in ppm
1	2	3	4
S1	0.5 km north	80 feet	0.1
S2	1 km north	120 feet	0.0
S3	1.5 km north	100 feet	0.03
S4	1.00 km north East	60 feet	0.056
S5	0.25 km north	50 feet	0.07
S6	1.5 km north East	80 feet	0.05
S7	2.0 km north	100 feet	0.00
S8	2.5 km north	120 feet	0.00
S9	3.0 km north	100 feet	0.00
S10	2.0 km north west	60 feet	0.04
S11	2.5 km north west	80 feet	0.05
S12	1.5 km north west	60 feet	0.06
S13	1.0 km north west	100 feet	0.00
S14	0.5 km north west	100 feet	0.00
S15	0.25 km north west	95 feet	0.00

Table 2 Chromium contamination in ground water sample of Kadwa Panchayat.

Sample numbers	Distance from the Koshi river	Depth. Of tubewell	Cr (vi) Concentration in ppm
1	2	3	4
S1	0.5 km north	80 feet	0.00
S2	1 km north	120 feet	0.02
S3	1.5 km north	100 feet	0.00
S4	1.00 km north East	60 feet	0.00
S5	0.25 km north	50 feet	0.00
S6	1.5 km north East	80 feet	0.01
S7	2.0 km north	100 feet	0.00
S8	2.5 km north	120 feet	0.00
S9	3.0 km north	100 feet	0.00
S10	2.0 km north west	60 feet	0.00
S11	2.5 km north west	80 feet	0.00
S12	1.5 km north west	60 feet	0.00
S13	1.0 km north west	100 feet	0.00
S14	0.5 km north west	100 feet	0.02
S15	0.25 km north west	95 feet	0.01

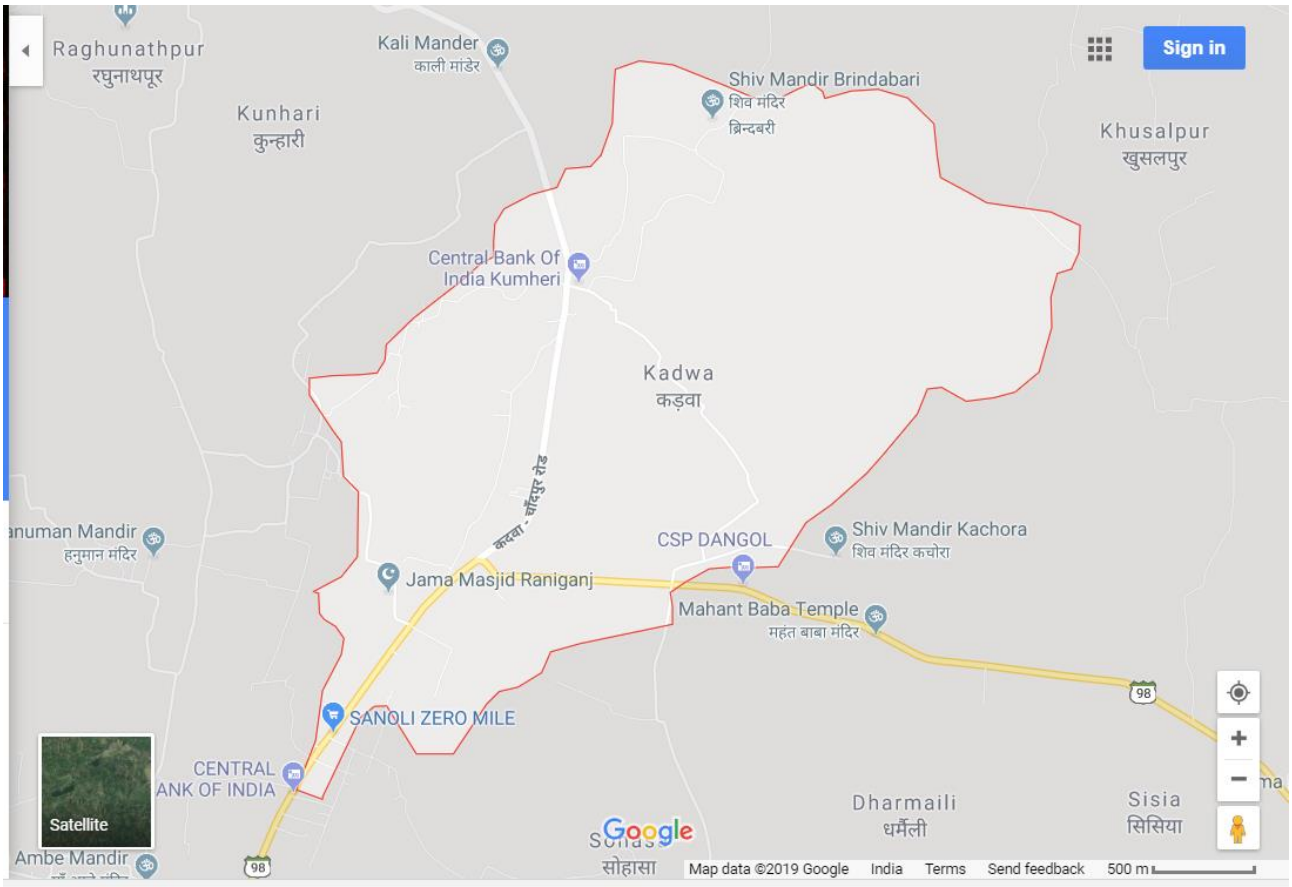

Figure 1. Google map of Kadwa Panchyat

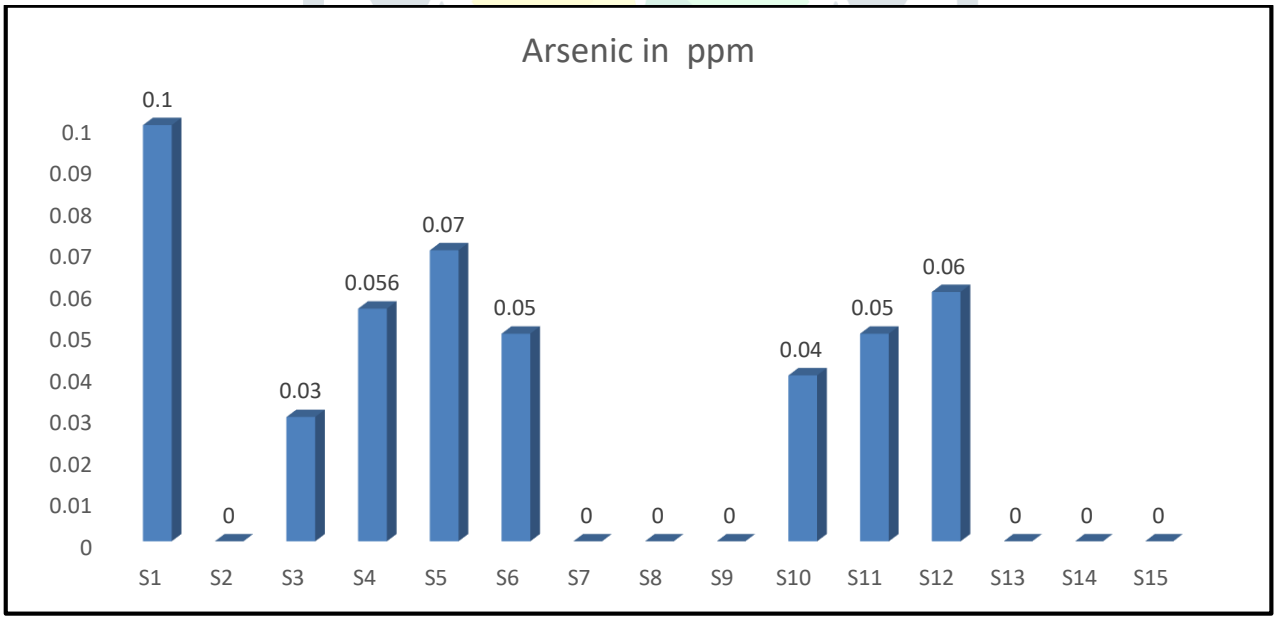

Figure 2. : Graphical representation of Arsenic (III) concentration in groundwater of Naugachia Kadwa Panchayat.

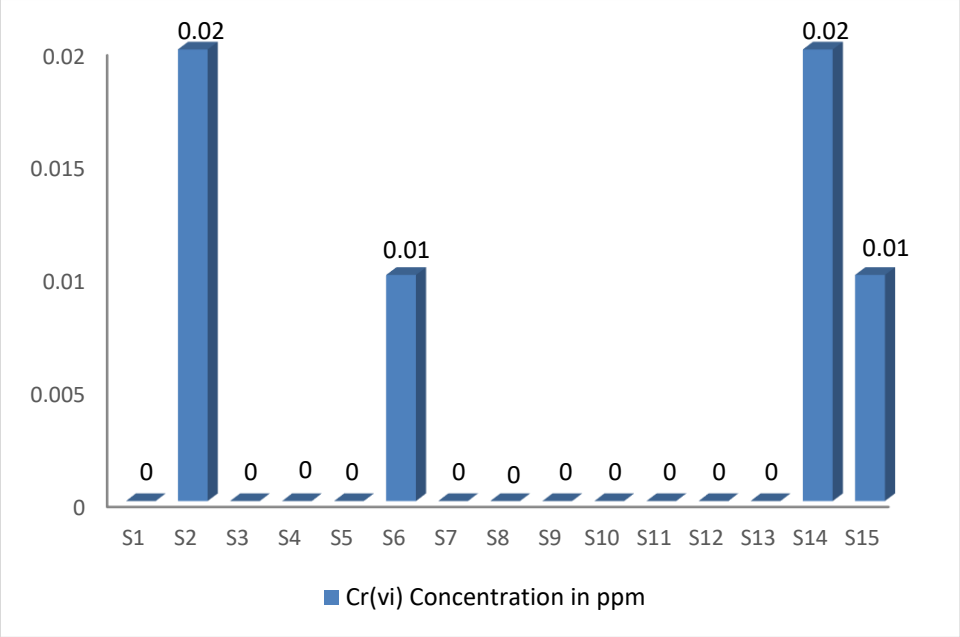

Figure 3. : Graphical reprsention of Cr (VI) concentration in groundwater of Naugachia Kadwa Panchayat.

Almost all the samples are free from hexavalent chromium concentration whereas S1, S2, S6, S14, and S15 samples contain Cr(VI) less than permissible limit of 0.05 ppm. During random sampling of ground water, it has become clear that water samples of this area is free from Cr (VI) contamination. It has been observed that ground water samples of this particular panchayat are contaminated with arsenic.It occurs mainly in the shallow ground water where as at deeper aquifer there is no trace of arsenic[5-7]. The studies have revealed that only few tubewells, of this Panchayat contain Arsenic above permissible limit and no case of skin lesions, hyperpigmentation and other related diseases are present among the inhabitants of this Panchayat[8-11],. Arsenic free deep aquifer may be utilized for the welfare of the society as well as ground water recharge and rain water harvesting should be adopted [12-13]

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