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ASSESSMENT OF GROUND WATER QUALITY OF GHAZIPUR DISTRICT, EASTERN UTTAR PRADESH, INDIA, SPECIAL REFERENCE TO ARSENIC CONTAMINATION

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Abstract
Now a days water quality has solicited a major global concern due to ever increasing human developmental activities that over exploit and pollute the water resources on surface and underground. Situation is very worst in developing as well as developed nations. In this context the status of water quality of Gazhipur district of Eastern Uttar Pradesh of India was carried out for the present study to identify the arsenic contamination of ground water. Arsenic contamination in ground water in India was first identified in lower Ganga plain of West Bengal later on Bihar, Jharkhand and also apprehended in Uttar Pradesh. Keeping the view to arsenic contamination in adjacent district Ballia, the present investigation therefore has been undertaken the possible arsenic contamination in and around Ghazipur district of eastern Uttar Pradesh.

Key Words: Arsenic contamination, cationic chemistry, heavy metals, TDS, water quality.

Introduction
Water pollution has now reached a crisis point specifically in developing world. Almost every water body is polluted to an alarming level. Thus, estimation of quality of water is extremely important for proper assessment of the associated hazards (Warhate *et al.*, 2006). Aquatic ecosystem are not only source of water and resources, such as fish and crop for household and agro industrial uses, but are vital parts of natural environment on which economic systems are parasites and depend for their survival (Rai and Pal, 2001).

The presence of arsenic in ground water has been reported from many parts of the world particularly in the Bengal delta and Bangladesh (Berg *et al.*, 2001), China (Kinniburgh and Smedley, 2001), Vietnam (UNESCAP-UNICEF-WHO, 2001) and Nepal (Tandukar *et al.,* 2001). The typical cutaneous arsenical manifestations have been observed among German wine groves due to exposure of calcium and lead arsenate pesticide (Wolf, 1976). Mortality rates were studied surrounding a pesticides factory where the population is exposed to arsenictrioxide, lead arsenate and calcium arsenate. A total of 143 males and 43 females died due to arsenic toxicity (Mabuchi *et al.*, 1979). Cases of lung cancers were reported in France among workers engaged in spraying of insecticides containing inorganic arsenic (Roth, 1958). Workers involved in formulating and packaging of insecticides containing lead arsenate, calcium arsenate and copper-acetoarsenite (Paris-Green) show higher degree of arsenic related diseases (Ott *et al.*, 1974). The typical arsenic manifestations and chronic arsenic poisoning were detected in Japanese workers, exposed to lead arsenate and calcium arsenate during pesticide preparations (Hamada and Horiguchi, 1976).

Arsenic contamination in India is well documented (Datta and Kaul, 1976; Garai *et al.*, 1984; Dhar *et al.*, 1997; Chakraborti *et al.*, 2002, 2003). It is reported that parts of all the states and countries surveyed in the Ganga–Meghna–Brahmaputra(GMB) plain, which has an area of approximately 500000 km^2 and a population over 500 million, are at risk from ground water arsenic contamination (Chakraborti *et al.*, 2004). However, recent studies by Acharyya and Shah (2004, 2005, 2007) and Shah (2008) have shown that arsenic contamination in Middle Ganga plains are restricted to narrow entrenched channels, and major part of the Ganga plains' inter fluve upland is found to be unaffected, thus questioning the extent of population at risk in this region. Current knowledge on the contamination status of arsenic in ground water in five states of India namely, Uttar Pradesh, Bihar, Jharkand, Assam and West Bengal has been discussed in detail (Nickson *et al.*, 2007). Recently, Ahamed *et al.* (2006) conducted a survey in Ballia, Gazipur and Varanasi districts of Uttar Pradesh. Analyses of 4780 tube well water samples revealed that arsenic concentrations exceeded 10 µg L^{-1} in

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46.5%, 50 µg L^{-1} in 26.7% and 300 µg L^{-1} in 10% of the samples.

Hence it is important to study the correlation of arsenic with various species like pH, TDS, F, NO_3, Fe and As for assessment of arsenic mobilization. Understanding the mechanism for mobilization may elucidate the predominant arsenic species to plan for proper mitigation steps in arsenic-affected areas of Ghazipur district.

Material and Methods

Selection of sites: Ghazipur is located at 25.58°N and 83.57°E and an average elevation of 62 meters (203 feet).The city of Ghazipur is located in the middle Ganges valley of North India, in the Eastern part of the state of Uttar Pradesh, along the left is bank of the Ganges river. It is the headquarters of the Ghazipur district. The city nearly stretches parallel to the river Ganges. Its neighboring cities are Varanasi, Jaunpur,Ballia, Mau, Chandauli and Azamgarh. Initially Ballia and Mau were part of Ghazipur district but latter were made separate districts.

Ghazipur has a humid subtropical climate with large variations between summer and winter temperatures. Summers are long, from early April to October, with intervening monsoon seasons. Cold waves from the Himalayan region cause temperatures to dip across the city in the winter from December to February. The temperature ranges between 32°C – 46°C in the summers, and 5°C – 15°C in the winters. The average annual rainfall is 1110 mm. Fog is common in the winters, while hot dry winds, called loo, blow in the summers.

Being located in the plains of Ganges the soil is alluvial type and is fertile because of low level floods continually replenishes the soil. This makes agriculture the most important profession of the people. The town is predominantly agrarian and so is the economy. The district is divided into four major sub parts Zamania, Mohammadabad, Saidpur and Jakhania. Following twelve villages namely Karkatpur, Sherpur,Tulshipur, Bhagirathpur, Garuamakshudpur, Reotipur, Medanipur, Suhawal, Kalyanpur, Kusumpur, Gaurahat, Ghazipur City and Sukhadehara have been selected for the present study (Figure 1).

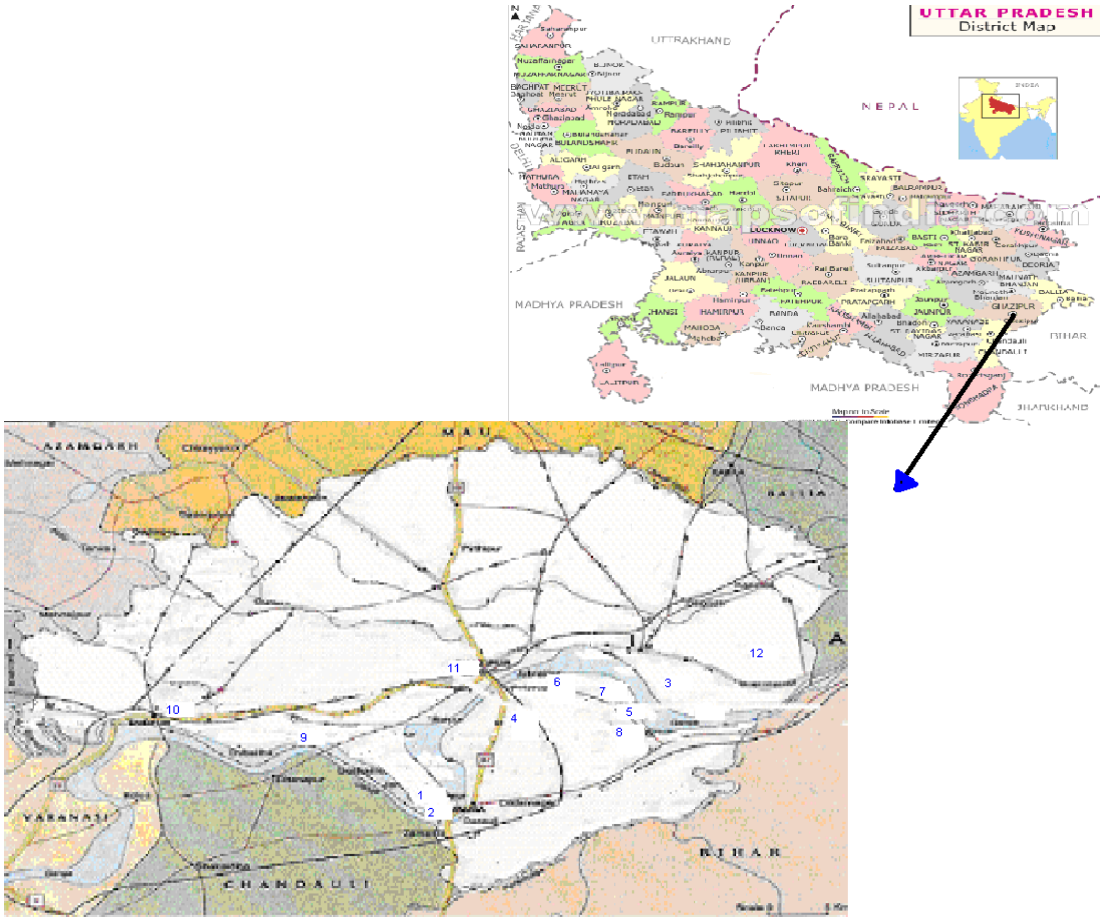

Figure 1: Representing the sampling location. 1.Karkatpur, 2. Sherpur-Tulshipur, 3.Bhagirathpur, 4.Garuamakshudpur, 5.Reotipur, 6.Medanipur, 7.Suhawal, 8. Kalyanpur, 9. Kusumpur, 10. Gaurahat, 11.Ghazipur city, 12. Sukhadehara

Sample collection:

Ground water sample were collected from shallow tube wells from Ghazipur districts, Uttar Pradesh in 500ml capacity of plastic bottles, pre-washed with detergent, tap water and distilled water were used for the collection around 30-40 l of water was flushed from the hand pump before collection of samples. One ml of Conc. HCl was added as a preservative and water was filled to the brim of the bottle without any bobbles.

The materials were used the following: WFTK kit (Wagtech Arsenator) cat no. wag-WE 10600, Wagtech International, U.K.CFTK Arsenic Field kit (Chem-in crop field kit acquired from chem-in Corporation, Pune, India). Arsenic(iii) (Acros organics cat no. 19582-1000, and arsenic(v) (EMerk cat no. 19773.0500) standard, silverdiethyl dithiocarbomate (Sigma-Aldrich), Chloroform analar(merk), Hydrochloric acid analar (MERK).

Results and Discussion

The present investigation was conducted in twelve village of Eastern Uttar Pradesh, with special reference to Ghazipur District to observe the Arsenic contamination in ground water quality (Table – 1). It has been observed that the minimum pH 7.5 in Kusumpur and maximum pH 8.0 in two villages namely Garuamakshudpur and Ghazipur city showing the slightly alkaline in nature. The minimum TDS 340ppm was found in the Kusumpur village where as the Maximum concentration of TDS 660 ppm was in Garuamakshudpur.

The minimum concentration of F (0.6ppm) was observed in Karkatpur and maximum (1.0ppm) were determinened in Gaurahat. Nitrate concentration were reported minimum (18 ppm) in the two village namely Sherpur and Kusumpur and maximum nitrate (24 ppm) in Gaurahat.

Table 1 : Ground water quality of Ghazipur district

Sl. No.	Study areas	pH	TDS(ppm)	F(ppm)	NO_3(ppm)	Fe(ppm)	AS(ppb)
1	Karkatpur	7.8±0.085	460±42.45	0.6±0.07	22±0.863	1.7±0.180	92.2±2.590
2	Sherpur Tulshipur	7.7±0.050	500±22.37	0.8±0.086	18±0.863	0.6±0.070	74.4±1.030
3	Bhagirathpur	7.8±0.079	540±28.30	0.8±0.086	23±0.863	1.3±0.180	91.0± 2.259
4	Garuamakshudpur	8.0± 0.069	660±17.33	0.8±0.086	22±0.863	0.9±0.132	87.8±2.946
5	Reotipur	7.6±0.053	400±22.37	0.6±0.070	27±1.733	0.9±0.132	74.2±1.009
6	Medanipur	7.7±0.082	560±28.30	0.8±0.086	23±1.803	1.3±0.180	79.8±0.607
7	Suhawal	7.6±0.031	420±14.15	0.8±0.086	22±2.501	0.7±0.086	47.4±1.063
8	Kalyanpur	7.7±0.072	580±26.47	0.6±0.070	22±0.863	1.3±0.180	89.0±0.707
9	Kusumpur	7.5±0.015	340±28.30	0.6±0.070	18±0.863	0.7±0.086	ND
10	Gaurahat	7.7±0.088	500±31.64	1.0±0.111	24±2.062	1.8±0.141	96.0±1.395
11	Ghazipur city	8.0±0.16	620±26.47	0.8±0.132	28±0.863	0.8±0.180	ND
12	Sukhadehara	7.8±0.085	520±26.47	0.7±0.086	20±1.118	1.4±0.173	92.8±1.127

ND : Not detected.

The pH and TDS of selected sampling sites is found within the prescribed permissible limit of WHO, 2004. The minimum (0.6 ppm) concentration of Fe was observed in Kusumpur where as maximum (1.8 ppm) in Gaurahat. The regions of maximum Fe concentration may be the natural weathering caused by river and Fe being formed and percolate in to ground water.

In the sampling sites concentration of As were observed in minimum (74.2 ppb) in Reotipur and maximum (96.0 ppb) in Gaurahat. The region of maximum arsenic concentration may be the natural weathering caused by river and arsenic being formed and percolate in to ground water. Another region may be that land of these villages is known well for agricultural point of view and many types of pesticides are used for protection of crops. These arsenic being pesticides are percolated with runoff and irrigational water into ground water.

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