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ANALYSIS OF ARSENIC CONTAMINATION IN DISTRICT AZAMGARH, UTTAR PRADESH, INDIA

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Abstract: The problem of arsenic contamination in ground water is the serious problems of every country in the present time. The contamination of drinking water supplies with natural occurring arsenic is major health problem. In the present paper, authors have analyzed the arsenic contamination in district Azamgarh, Uttar Pradesh, India. The complete study is divided in three categories of arsenic namely Category-I (satisfactory), Category-II (risky) and Category-III (critical). For this, authors selected ten study sites (Palhana, Phoolpur, Rani ki Sarai, Azmatgarh, Pawai, Sathiaon, Tahabarpur, Tarwa, Thekma and Palhani) of district Azamgarh, Uttar Pradesh, India with two types of samples from shallow water and deep (India mark II) water. Results are presented in the tabular form and show that eight sites (Rani ki Sarai, Azmatgarh, Pawai, Sathiaon, Tahabarpur, Tarwa, Thekma and Palhani) out of ten study sites of district Azamgarh, Uttar Pradesh, India lie under Category-III for both types of shallow and deep (India mark II) water. Phoolpur is the only site which has satisfactory arsenic water contamination. The shallow water of all ten study sites of district Azamgarh, Uttar Pradesh, India is not fit for drinking without processing.

Keywords: Arsenic; Samples; Azamgarh; Wagtech Digital Arsenator

Introduction: Human system is very sensitive to arsenic. The excess arsenic may causes sufficient damage to human health and these may be respiratory distress due to irritation of mucous membranes, resulting into laryngitis, myocardial depolarization, bronchitis or rhinitis and cardiac arrhythmias that may lead to heart failure, gastrointestinal effects like burning lips, painful swallowing, thirst, nausea and abdominal colic. Acharyya [1] discussed the source and mobilization process of arsenic contamination in ground water which

affecting major parts of the Southern West Bengal and Western Chattisgarh. Bates et al. [2] studied the bladder cancer due to arsenic in drinking water.

Bhattacharjee et al. [3] determined the metal contents in the groundwater of Sahebgunj district, Jharkhand, India, with special reference to arsenic. Arsenic exposure through groundwater to the rural and urban population in the Allahabad-Kanpur track in the upper Ganga plain was discussed by Chakraborti et al. [4]. Chatterjee et al. [5] discovered ground water contamination by arsenic in the residential area of Behala, Calcutta due to industrial pollution. Chatterjee et al. [6] studied the effect of arsenic in groundwater in six districts of West Bengal, India and determined that arsenic species are present in the drinking water and urine of the affected people of West Bengal.

Chaudhary et al. [7] examined the ground water contamination in Ludhiana, Punjab, India. Chaurasia et al. [8] gave a review on figure print of arsenic contaminated water in India. Cancer potential in liver, lung, bladder and kidney due to ingested inorganic arsenic in drinking water was discussed by Chen et al. [9]. Chowdhury et al. [10] calculated ground water arsenic contamination in Bangladesh and West Bengal, India. Das et al. [11] analyzed arsenic in ground water in six districts of West Bengal, India.

Das et al. [12] studied the effect of arsenic in ground water in six districts of West Bengal, India and determined that arsenic concentration was present in drinking water, hair, nail, urine, skin scale and liver tissues (biopsy) of the affected people of six districts of West Bengal, India. Dhar [13] showed that arsenic contamination of ground water is a major public problem in Bangladesh. A review of the arsenic cycle in natural waters was given by Ferguson and Gavis [14]. Keya [15] discussed the mental health of arsenic victims in Bangladesh.

Mandal and Suzuki [16] gave a review on the topic arsenic round the world. A case study of arsenic pollution of groundwater in parts of West Bengal was given by Mukopadhyay and Ghosh [17]. Nahar [18] examined some villages of Bangladesh and gave the impact of arsenic contamination in groundwater of these villages. Worldwide occurrences of arsenic in ground water were studied by Nordstorm [19].

Safiullah [20] gave an overview on the arsenic pollution in the groundwater in Bangladesh. Sarker and Mohiudin [21] discussed the impact of arsenic contamination in ground water on the socio-economic and cultural life of the people of Bangladesh. Arsenic contamination and its management were studied by Singh et al. [22]. Smedley and Kinniburgh [23] gave a review on the source, behavior and distribution of arsenic in natural waters. Smith et al. [24] determined that the people of Bangladesh are affected by many skin diseases due to contamination of drinking water by arsenic and very much needed for public health emergency.

Tripathi and Dwiwedi [25] studied the effect of arsenic in groundwater of adjoining areas of Gorakhpur district (U.P.), India. Wyllie [26] gave an investigation of the source of arsenic in well water. Singh and Singh [27] discussed the problem of arsenic contamination in ground water of Ballia, Uttar Pradesh

state, India. Katiyar and Singh [28] exposed the existence of arsenic in drinking water of the population of Ballia district and determined its correlation with blood arsenic level. Saxena et al. [29] studied the source mineral for the release of arsenic in the groundwater of Karanda block, Ghazipur District, Uttar Pradesh.

Seasonal variation of arsenic concentration in groundwater in Ghazipur District of Uttar Pradesh was studied by Azam [30]. Kumar et al. [31] quantified the Arsenic in groundwater in the middle Gangetic Plain of Ghazipur District in Uttar Pradesh, India. Pandey et al. [32] reviewed the Arsenic pollution scenario in eastern UP, India. Asthana and Dwivedi [33] studied the arsenic contamination in district Ghazipur (U.P.), India. Asthana and Dwivedi [34] analyzed the arsenic contamination at district Ballia (U.P.), India.

The main aim of this paper is to determine the effect of arsenic contamination in district Azamgarh, Uttar Pradesh, India.

Material and Methods: Ten sites (Palhana, Phoolpur, Rani ki Sarai, Azmatgarh, Pawai, Sathiaon, Tahabarpur, Tarwa, Thekma and Palhani) were selected from the district Azamgarh, Uttar Pradesh, India for this study. There are two types of samples namely Shallow and Deep (India Mark II) of water are taken from each study sites. Total twenty samples were collected. Samples were collected during the summer seasons in the months of June 2019 to August 2019 because in this time period water level remains lower. Authors have considered following important precautions in collecting the samples of water.

- Water samples were collected in neat, clean and transparent plastic bottles with tight bottles cap.
- Gloves were used by authors when collecting these samples.
- Samples were collected after ten minutes operating the pumps in order to get the fresh water.
- Samples were kept in dark places to avoid direct sunlight because some changes might

All the collected samples are tested for arsenic determination in “Pollution and Environment Assay Research Laboratory (PEARL)” of D.D.U. Gorakhpur University, Gorakhpur, Uttar Pradesh, India under the supervision of Anil Kumar Dwivedi. The reading of arsenic obtained using “Wagtech Digital Arsenator” (see Figure 1) which has 1 ppb-500 ppb (parts per billion) range and present in the “Pollution and Environment Assay Research Laboratory (PEARL)” of D.D.U. Gorakhpur University, Gorakhpur, Uttar Pradesh, India.

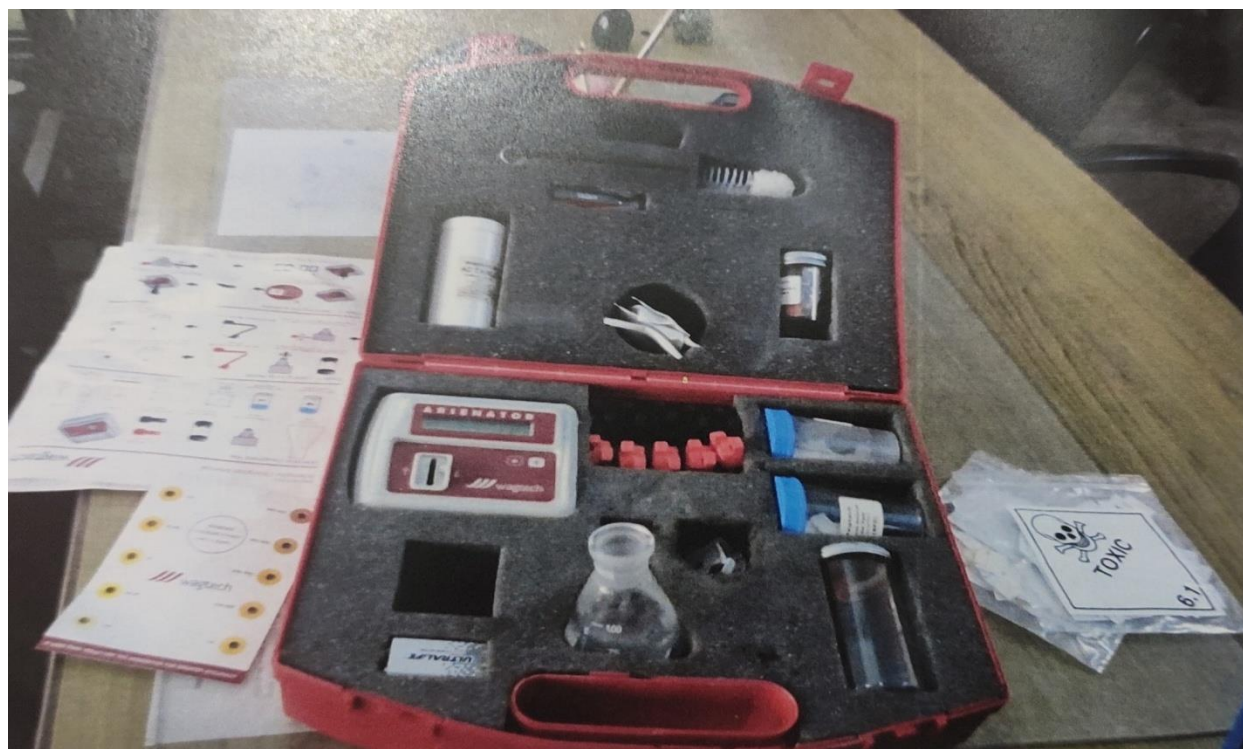


Figure: 1 Wagtech Digital Arsenator

Results and Discussion: For better understanding of the results, authors divided the arsenic concentration in the three categories namely Category-I (satisfactory), Category-II (risky) and Category-III (critical) (see Table: 1). Results of our ten study sites after analyzing the twenty samples of water (Shallow and Deep) are presented in the Table: 2. Results depict that the sites Palhana, Rani ki Sarai, Azmatgarh, Pawai, Sathiaon, Tahabarpur, Tarwa, Thekma and Palhani have critical level of arsenic water contamination for both shallow and deep (India Mark II) water. Phoolpur is the only site which has satisfactory arsenic water contamination.

Table: 1 Categories of Arsenic Concentration

Category Name	Range of Arsenic Concentration
Category-I (satisfactory)	<0 ppb to <5 ppb
Category-II (risky)	5 ppb to ≤10 ppb
Category-III (critical)	>10 ppb

Table: 2 Arsenic Levels of Water Samples of the Ten Selected Study Sites

S.N.	Name of Study Site	Water Depth	Category-I (satisfactory)	Category-II (risky)	Category-III (critical)
1	Palhana	Shallow			32
		Deep (India Mark II)		10	
2	Phoolpur	Shallow		10	
		Deep (India Mark II)	4		
3	Rani ki Sarai	Shallow			43
		Deep (India Mark II)			13
4	Azmatgarh	Shallow			66
		Deep (India Mark II)			13
5	Pawai	Shallow			53
		Deep (India Mark II)			16
6	Sathiaon	Shallow			805
		Deep (India Mark II)			22
7	Tahabarpur	Shallow			137
		Deep (India Mark II)			15
8	Tarwa	Shallow			69
		Deep (India Mark II)			11
9	Thekma	Shallow			106
		Deep (India Mark II)			13
10	Palhani	Shallow			199
		Deep (India Mark II)			15

Conclusion: Results of the present study indicate that

- Shallow ground water of district Azamgarh, Uttar Pradesh, India is not safe for the purpose of drinking.
- The water of deep bore wells is also not suitable for the purpose of drinking, which is a serious and critical problem for district Azamgarh, Uttar Pradesh, India except Phoolpur.
- The problem of arsenic contamination in the ground water at Rani ki Sarai, Azmatgarh, Pawai, Sathiaon, Tahabarpur, Tarwa, Thekma and Palhani is a very serious problem for district Azamgarh, Uttar Pradesh, India.

- The deep ground water of Phoolpur can be used for drinking until some preventive measures taken for the purification of water.
- The deep ground water of Palhana is at the border line of Category-III (critical).

Recommendation: On the basis of the study, it is recommended that

- The shallow ground water of all ten study sites (Palhana, Phoolpur, Rani ki Sarai, Azmatgarh, Pawai, Sathiaon, Tahabarpur, Tarwa, Thekma and Palhani) of district Azamgarh, Uttar Pradesh, India is not fit for drinking.
- The deep ground water of nine study sites (Palhana, Rani ki Sarai, Azmatgarh, Pawai, Sathiaon, Tahabarpur, Tarwa, Thekma and Palhani) out of ten sites is a deep concern for citizens of district Azamgarh, Uttar Pradesh, India
- Government should take some strict action for this issue and should also set up water purifier as many as possible at district Azamgarh, Uttar Pradesh, India.

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Conflict of Interests: There is no conflict of interest between the authors.

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