

Status of Groundwater Arsenic Contamination in Malda District, West Bengal, India

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Abstract: 'Arsenic', this word is always a term of concern to us. Ground water arsenic contamination has been found in different parts of the world. It is always not injurious to us if present in permissible amount. Historically arsenic is reported as a poison. Severe arsenic contamination has been reported from west Bengal. The problem of presence of arsenic in danger level is reported since 1978 in this region. Arsenic concentration exceeding 0.05 mg/L in drinking water can cause cardiovascular problem, neurological effects, hematological effects, gastrointestinal problem etc. The aim of this paper is to discuss the present condition of groundwater arsenic contamination of critically affected areas like Kaliachak (I,II and III Blocks), Manikchak, Ratua and Englishbazar blocks of Malda District of West Bengal. The data are collected from specified sources of Govnment like CMOH Office, PHE Department, and District Web Portal.

Index Terms: arsenic, groundwater, contamination, Malda

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1. Introduction: Arsenic is a metalloid which mainly exists in +3(arsenite) and +5 oxidation states in ground water and in surface water environment. At normal condition arsenate exists as $\text{H}_2\text{AsO}_4^{-1}$, HAsO_4^{-2} whereas arsenite as H_3AsO_3 , $\text{H}_2\text{AsO}_3^{-1}$. Arsenic associates with rocks, soils and sediments due to discharge from industrial sources and use of pesticides. Thus it enters into the groundwater and in our food chain. Arsenite at higher pH level is strongly bound to soil components and found to be comparatively more toxic in nature. The arsenic poisoning in the Bengal Basin of West Bengal which is situated in the top deltaic plane of Ganga-Bhagirathi river system. The contamination of ground water in the West Bengal is one of the largest environmental poisoning disasters. It is reported that different modern techniques like Arsenic Content, pH measurement, Dissolve oxygen, Salinity, Specific conductivity are implied by the concern authority to determine the arsenic concentration within a range of 10-30 m depth. Actually the source of arsenic in deltaic plain of West Bengal is considered to be the arsenic rich sediments transported from Chotanagpur Rajmahal hill. Here there is deposition of Fe and Mn along with As. The main objective of the study are to study extent of impact of arsenic

contaminated ground water, to locate the major arsenic affected areas and to find out the causes of presence of arsenic in high amount exceeding permissible limit.

2. Demography: The present study was mainly confined to four blocks namely Kaliachak I, II and III and English Bazar of Malda of West Bengal which covers almost 500 kms of area. Malda district is situated at altitude of $25.01018^{\circ}\text{N}, 88.1411^{\circ}\text{E}$ which is just near to west of Bangladesh-India border. The study area is originated from a part of Ganga-Brahmaputra delta, where there is a quaternary sediment deposition by Ganga- Pagla –Mahananda River which is just adjacent to west part of Bangladesh. According to the Arsenic Concentration School of Environmental Studies, Jadavpur University, Kolkata, West Bengal is classified into three regions i.e. highly affected, mildly affected and moderately affected. Our area of study falls in the highly affected zone

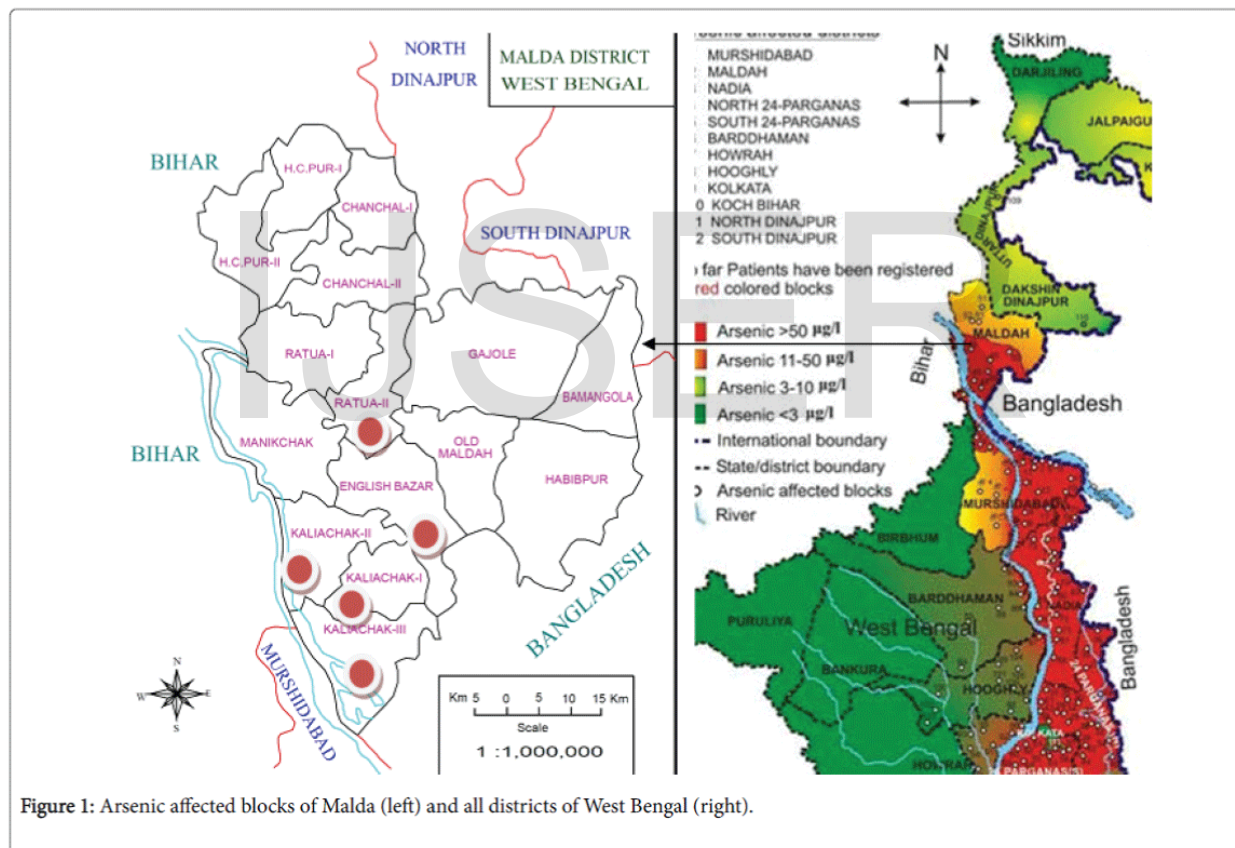


Figure 1: Arsenic affected blocks of Malda (left) and all districts of West Bengal (right).

Figure 1: Arsenic affected blocks of Malda and all districts of West Bengal

3.Data Source: To have a complete knowledge about the present situation of arsenic contamination in Malda district, data have been collected from Govt.reports, PHE Departmental report, Planning Commission report, Malda district Portal, CMOH Department .

Table 1: Districts in West Bengal affected by Arsenic Toxicity District Concentration in mg/L

• South 24 Parganas	0.06-3.20
• North 24 Parganas	0.06-1.28
• Malda	0.05-1.434
• Nadia	0.05-1.00
• Murshidabad	0.05-0.90
• Bardhaman	0.10-0.50
• Howrah	0.09
• Hooghly	0.60

Source: REPORT OF THE TASK FORCE ON FORMULATING ACTION PLAN FOR REMOVAL OF ARSENIC CONTAMINATION IN WEST BENGAL

4.Sample Collection: Almost 20 samples are taken from different water sources like deep tube wells and dug wells, ponds of Kalichak and English Bazar block and they are coded as A.EB 1, AKCK 11, AKCK 12, ,AKCK 13, A.EB 2, A.EB 3, A KCK 21, AKCK 22, ,AKCK 23, AKCK 31, A KCK 32, A KCK 33.

5.Experimental: Different samples are collected from different blocks of Malda District and analyzed by merckoquent arsenic kit available in the physical chemistry lab of Department of Chemistry, T.M.Bhagalpur University, Bihar.0.10 ml of sample was taken by syringe provided in kit and kept in reagent bottle followed by addition of a spoon of As I with shaking till dissolved. Then two spoon of As II was added and immediately the bottle was closed and strip of kit was inserted and solution is shaken mildly up to 20 mins. Then the colour of the white strip changes and then the colour were matched with pH scale. The samples were also analyzed by U.V.double beam spectrophotometer. PH (acidity-alkalinity ratio), was determined by potentiometric process by using reference electrode. Conductivity determined the total concentration of ionized constituent present in solution which can be measured by the Principle of Wheatstone Bridge. Salinity is measured by using indirect methods that involves measurement of conductivity and density. Except these, Total dissolved solids, Dissolved Oxygen have been measured.

Table 2: District-wise report Groundwater contamination report

Sl. No.	Districts	Total no. of public tube wells	% of tube wells with Arsenic 0.05 mg/l	No. of affected mouzas	No. of affected habitation
1.	Burdwan	6518	6.46	76	102
2.	Hooghly	2087	12.22	41	91
3.	Howrah	879	0.34	3	3
4.	Malda	19279	28.72	311	871
5.	Murshidabad	40593	30.66	791	1218
6.	Nadia	29640	25.28%	937	1945
7.	24 Pgs (N)	25987	25.76%	927	2124
8.	24 pgs. (S)	7284	6.59	143	269
		1,32,267	25.20%	3229	6623

Source: REPORT OF THE TASK FORCE ON FORMULATING ACTION PLAN FOR REMOVAL OF ARSENIC CONTAMINATION IN WEST BENGAL

6.Result and Discussion: The results obtained from different tests show that mean level of arsenic in Kalichak I, II and III are 0.2253 mg/L, 0.1923 mg/L, 0.1755 mg/L respectively whereas in English Bazar, it is 0.1755 mg/L. The maximum concentration of As ranges at a depth of 10-20 m in all blocks of Kaliachak.34.7%,47.9% and 25.7% of Arsenic content (>.05 mg/L) was found in Kalichak I,II and III blocks respectively. Whereas 22.04%, 19.2% and 34% of ground water was found to be less arsenic contaminated (<.05 mg/L) in Kaliachak I, II and III respectively. In English Bazar Block maximum arsenic content was found at a depth of 20-30 m where 14.29% was in death range(>.05mg/L).

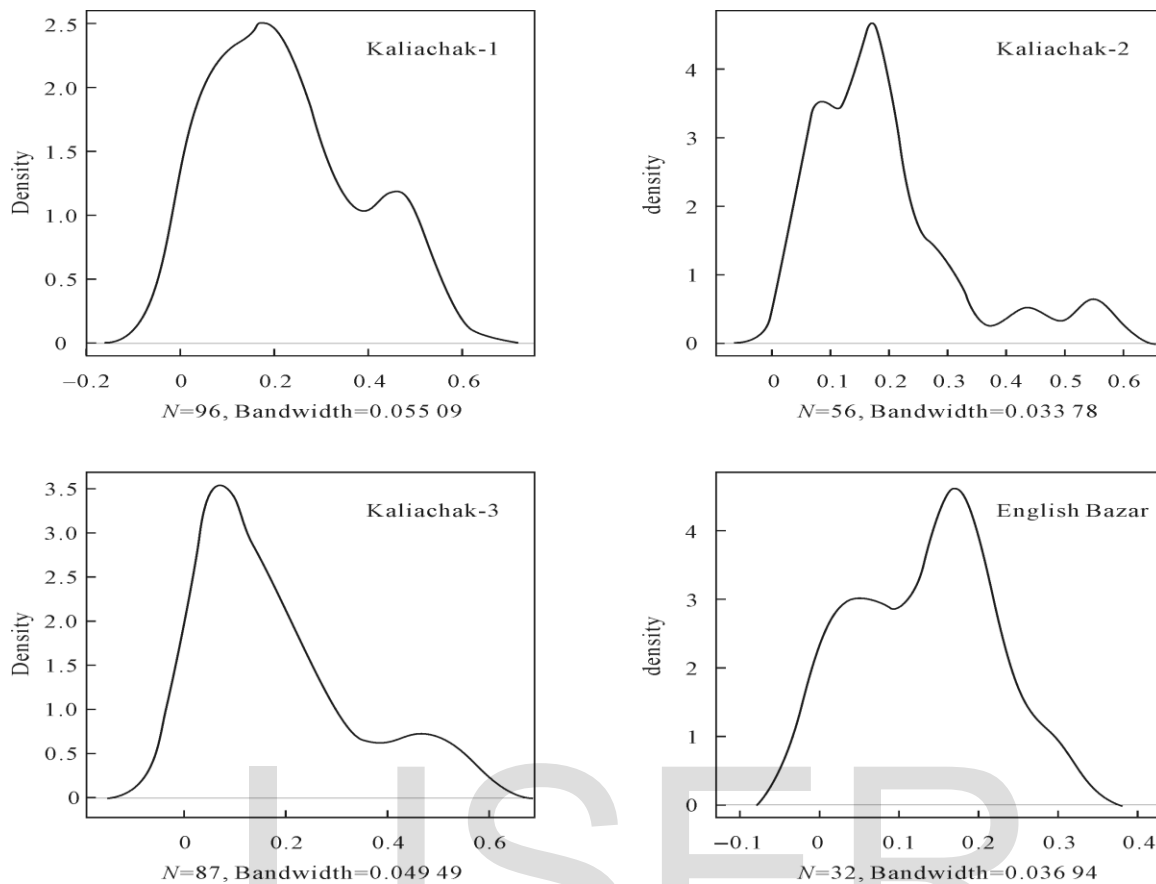


Figure 2: Malda District wise Arsenic density in ground water Department

So out of all these arsenic affected blocks, English Bazar was found to have least mean arsenic level. In arsenic affected areas, the ground water is generally mild acidic to alkaline in nature (pH varies from 6.78-8.41). It is reported that shallow water is associated with high iron, low DO (0.17 mg/L), low sulphate (<1 mg/L) and low chloride (5 mg/L). In Malda, especially in monsoon period, the arsenic content is lowered which is due to maximum arsenic intake by micro organisms. It is observed that, larger the average level of Arsenic contamination, greater is the influence of depth. It is reported that some of the research workers have a strong thinking that due to commercialization of agro products lowered the ground water level (20-60) m. The percentage of arsenic is found to be very high at that level. However there is a lot of debate regarding the cause of arsenic contamination.

Sample Number	Place from	Depth of ground water source(meter)	Amount of detected arsenic in tested sample(mg/L)
A.EB 1	S.M.PALLY	15	0.01
AKCK 11	ALINAGAR	20	0.7
AKCK 12	CHHOTA SUZAPUR	20	0.5
AKCK 13	SULTANGANJ	20	0.5
A.EB 2	MAHESHMATI	15	0.02
A.EB 3	MOKDUMPUR	12	0.01
A KCK 21	DHARAMPUR	20	0.5
AKCK 22	GANGAPRASAD	20	0.5
AKCK 23	KHANPUR	15	0.03
AKCK 31	BAISHNABNAGAR	18	0.6
A KCK 32	SAHABAZPUR	20	0.8
A KCK 33	GOLAPGANJ	20	1.0

Table 3: Arsenic Contamination in ground water samples of Malda District, West Bengal

Source	DF	SS	MS	F	Probability value (P)
Blocks	3	0.2389	0.0796	4.11	0.007
Error	259	5.0143	0.0194		
Level	N	Mean	Standard deviation	Pooled standard deviation	
Kaliachak-1	92	0.225	0.1495	0.1391	
Kaliachak-2	53	0.192	0.1279		
Kaliacha-3	86	0.175	0.1494		
English Bazar	32	0.132	0.0865		

Table 4: Source: Analysis of variance) with mean and standard deviation of arsenic (mg/L). Using four blocks (Kaliachak- 1, 2, 3 and English Bazar) as fixed effects, PHED REPORT

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8. Conclusion: From the reports and tests performed, it is obvious that there is a rapid expansion of arsenic concentration in ground water in Malda district which is a matter of great concern for the inhabitant of that region. Although the impact of arsenic in human body is slow but its effect is prolong and dangerous. Government is continuously taking appropriate steps to control the effect of this slow poison. Arsenic removal plants are established in Sujapur, Manikchak, Gour areas. Different measures like public awareness, supply of arsenic free water, use of boiling water, SOES and All&PH processes) and mineral (for NML) are being implemented. Municipality and Panchayat are drawing drinking water from the aquifer below 1000 ft level as upper layers are heavily contaminated either with Arsenic or iron. Initiatives should also be taken by NGO s to control arsenic contamination.

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