

Evaluation of arsenic concentration in drinking water in many villages of districts Shahajhnpur & Badaun (U.P.), Haridwar, Uttarakhand (India), located near Ganga region

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Abstract

Arsenic is natural occurring element in large amount in the earth's crust and in small amounts in rocks, soil, water and air. It has three forms of allotropes viz yellow, black and grey. It is a member of Fifth-A group of the periodic table. It is one of the most toxic elements, semi metal or conductor, colorless and tasteless. If arsenic is present in high amount in drinking water, can causes cancer like symptoms and other disorders. In UP, mainly districts Shahjahanpur, Badaun, Tehsils Tilhar, Jalalabad, DataGanj, Block Jaitipur & Dataganj, many villages have suspected amount of arsenic in drinking water. This element causes many types of disorders instead of cancer related disorder. The safe drinking water should be free from arsenic but permissible limit is 0.01 micron grams per liter (WHO) and 0.05 micron gram per (BIS & ICMR).

Introduction

Approximately 75% of our planet surface is covered with water, out of which about 90% is found in ocean, about 2% in polar of earth in the form of ice (Antarctica, Artica and Glaciers) and less than 1 % is fresh water for drinking water (Neerja *et al.*, 2012). Fresh water is the

one of the most survival for human beings as well as animals (aquatic and land life). In Uttar Pradesh, water sources are shallow and mainly hand pumps, tube wells, ponds and rivers are available for domestic as well as animal use. The shallow depth of available water could be the main cause of contamination of arsenic poisoning in water. Many villages were found unaware of arsenic poisoning because at some places water is available at very shallow depth at about 15 feet and more. This water was very contaminated for health purposes for human beings and animals. Many people's had complains related to water and health hazardous.

Theory

All arsenic compounds are poisonous. Despite their toxic effect inorganic arsenic bonds occur on earth naturally in small amounts. Arsenic is a common chemical element in the earth's crust. It is also one of the oldest poisons known to mankind (S.K Acharya, A.shah *et al* ;). At 19th century, arsenics was known as "Inheritance powder". Organic form of arsenic is fairly harmful to human health (Arthur I. Vogel 4th edition). The problem of arsenic pollution is

especially severe all over the Ganges River basin in India. During the so-called "Green Revolution" of the 1960s and 1970s, the cultivation of rice in flooded fields became pervasive, and workers dug open wells all over India through soil and rocks with naturally occurring arsenic. The result was widespread arsenic pollution from contaminated water. Arsenic decreases immunity of human beings (**Firdausi et al ;**). Groundwater arsenic contamination and sufferings of people have been reported in 20 Countries in different parts of the world. The magnitude is considered highest in five Asian Countries and the severities are in order of 1. Bangladesh 2. India 3. Magnolia 4. China 5. Taiwan (Niaz, 2011). Biotransformation is the main pathway of arsenic in human beings and animals. The intermediate product is more toxic than end product. Its methylation occurs in liver. Likewise monomethylarsenic acid (MMA) & dimethylarsenic acid (DMA) is less toxic than inorganic arsenic (**Nrasant singh et al**).

Routes of transmission:

There are many routes to transmit the arsenic e.g. Water (Main), Food, Air & Skin contact through soil.

Sign and Symptoms:

Symptoms of arsenic poisoning are headache, confusion, severe diarrhea and drowsiness. When the poisoning becomes acute symptoms may include diarrhea, vomiting, blood in urine, cramp, hair loss, stomach pains and chronic convulsion. The organs usually affected by arsenic poisoning are the lungs, skin, kidneys and liver. The finally result of arsenic poisoning is coma to death (**Sharrett A. R, Ahmad et al ;**). Arsenic is related to heart disease, stroke (cardiovascular disease), cancer, chronic lower respiratory disease and diabetes (Navas-Aein *et al.*, 2008). Long time exposure to arsenic is related to vitamin A deficiency which is related

to heart disease and night blindness (Hsueh *et al.*, 1998). The inorganic arsenite-III in distilled water is more toxic than organic arsenate-V (**Nrashant Singh et al;**). It is suggested that the uptake of prolonged and large amounts of inorganic arsenic can create chances of cancer development especially in case of skin cancer, infertility and miscarriages in pregnant women, heart disruption, brain damage in both men and women, hyperkeratosis, hypopigmentation, lung cancer, liver cancer and lymphatic cancer (**Libia Vega, Ehrenstein, Claudia et al ;**). Inorganic arsenic can damage DNA while organic arsenic can cause neither cancer nor DNA damage. Arsenic poisoning also decreases I.Q. level in children (**Wasserman et al ; Zhou et al., 2008). Arsenic interferes many steps and processes in the cellular level e.g. inhibits oxidation of pyruvate dehydrogenase which causes apoptosis, decrease uptake of thiamine, increase lactic acidosis, stimulates hydrogen peroxide production, activates endothelial nitric oxide synthase, induces platelets aggregation which causes atherosclerosis, induces cardiovascular pathogenesis (Konduri *et al.*, 2009).**

Diagnosis:

Urine (more reliable), Blood, Hairs, Fingernails, X-rays fluorescence spectroscopy, Micro particle induced x-ray emission.

Methodology:

Material: 25 ml water sample (Hand pump, ponds, river & tube well), collect about 50 ml of sample from different places e.g. Hand pump, bore well, distilled water, kit based reagent.

Site: Different sites of villages with sterile containers in a selected district of Uttar Pradesh & Uttarakhand (India).

Method: Rapid kit (Jal Tara)

Material for kit: kit apparatus, disc paper, color chart, tissue paper, distilled water, PH strip.

Material for reagent: A, B & C**Procedure:**

1. Take water sample in flask up to the mark (about 25ml).
2. Add solution A, B, & C in sample.
3. Pour mercury pellets in the sample and put holder which were assembled before.
4. Wait for evolution of arsenic from sample after 15 to 20 minutes.

Precaution:

1. Container must be sterile and wide mouthed.

2. Container/bottle should be wide mouthed for water collection.
3. Gloves must be wearing during performing test.

Result & Discussion:**Normal Range:**

According to **BIS/ICMR** Permissible limit = **50 ppb or 0.05 micron gram/ml.**

According to **WHO** permissible limit = **10 ppb or 0.01 micron gram/ml.**

S.N.	Place/Region	Depth & PH	Type	Result (ppb or micron gm/l)
1.	49/1/BHEL,HRD,UK	150 Feet & 7	Tap Water	10ppb or (0.01 micron gm/l)
2.	V&P:GRN,SPN,UP	70 Feet & 7	Handpump G	(0.05 ug/l)*
3.	V&P:GRN,SPN,UP	40 Feet & 7	Hand pump P	0.02 micron gm/l*
4.	V:Jora,P:Dh,SPN,UP	40 Feet & 7	Hand pump P	0.02 micron gm/l*
5.	V:Jora,P:Dh,SPN,UP	40 Feet & 7	Hand pump p	0.05 micron gm/l*
6.	D:Farukhabad UP	R.Ganga & 9	Running	0.05 micron gm/l*
7.	V:Maughatia,P:GRN,B:JR,SPN,UP	25 Feet & 7	Hand pump (N.Ganga)	0.01 micron gm/l
8.	V:Khamria,P:GRN,B:J,SPN,UP	40 Feet & 8	Hand pump	0.02 micron gm/l*
9.	V:Maujannagar,P:GRN,B:J,SPN UP	15 Feet & 8	Hand pump (G.Bank)	0.05 micron gm/l*
10.	V:Maujannagar,P:GRN,B:JR,SPN,UP	35 Feet & 8	Hand pump (N.Ganga)	0.02 micron gm/l*
11.	V:Khamria,P:GRN,B:J,SPN,UP	140Feet & 8	Hand pump	0.02 micron gm/l*
12.	V:Nawada(Rapadia),P:GRN,B:JR,SPN,UP	35 Feet & 7	Hand pump (Kh. Canal)	0.02 micron gm/l*
13.	V:Nawada(Rapadia),P:G.R.,B:Jaitipur,SPN UP	35 Feet & 7	Hand pump (K. Canal)	0.02 micron gm/l*
14.	V:Nawada(Rapadia),P:GRN,B:JR,SPN,UP	45 Feet & 7	Hand pump (Kh.Canal)	0.01 micron gm/l
15.	V:Nawada(Rapadia),P:GRN,B:JR,SPN,UP	80 Feet & 7	Hand pump (Kh.Canal)	0.01 micron gm/l
16.	V:Nawada Rapadia P:GRN,B:JR,SPN,UP	40 Feet & 8	Hand pump (Kh.Canal)	(0.05 micron gm/l)*
17.	V:Vudhwana,T:Jal.,SPN,UP	40 Feet & 8	Hand pump (N.Ganga)	0.01 micron gm/l
18.	V:Chachora,T:Jal.,SPN,UP	40 Feet & 8	Hand pump	0.05 micron gm/l)*
19.	V:Barua,T:Jal.,SPN,UP	45 Feet & 8	Hand pump (N. Ganga)	0.05 micron gm/l)*
20.	V:Bhudia,T:Jal.,SPN,UP	30 Feet & 8	Hand pump P	0.05 micron gm/l)*
21.	V:Ummarpur,T:Jal.,SPN,UP.	45 Feet & 7	Hand pump P	0.02 micron gm/l*

22.	V:Pehna, T:Jal.,SPN,UP.	40 Feet & 7	Hand pump P	0.01 micron gm/l
23.	V:Gauhapur,B:Jaitipur SPN, UP.	Runing & 9	Bahgul River	0.4 micron gm/l*
24.	V:Rudrapur,B:Jaitipur, SPN, UP.	40 Feet & 7	Hand pump (N.Ganga)	0.05 micron gm/l*
25.	V:Mausamnagar (chhotakesinagar),SPN,UP.	25 Feet & 8	Hand pump (N.Ganga)	0.2 micron gm/l*
26.	V:Khamria,B:Jaitipur,SPN, UP.	25 Feet & 7	Hand pump P	0.2 micron gm/l*
27.	V:ShimariaRaipur1, B:Jaitipur, SPN, UP.	30 Feet & 8	Hand pump P	0.02 micron gm/l*
28.	V:ShimariaRaipur-2B:jaitipur, SPN, UP.	30 Feet & 7	Hand pump (G.Bank)	0.1 micron gm/l*
29.	V:Khoobpur,B:Jaitipur, SPN,UP.	25 Feet & 8	Hand pump (G.Bank)	0.1 micron gm/l*
30.	V:Shivrajpur,B: Jaitipur, SPN, UP.	60 Feet & 7	Hand pump (N.Ganga)	0.05 micron gm/l*
31.	Haridwar UK (India)	Running & 9	Ganga River	0.2 micron gm/l*
32.	V:Bhudiya,B:Jaitipur SPN,UP.	25 Feet & 9	Hand pump (N.Ganga)	0.2 micron gm/l*
33.	V:Awa,B:Jaitppur,SPN,UP	25 Feet & 9	Hand pump (N.Ganga)	0.1 micron gm/l*
34.	V:Mausjampur,T:Dataganj Budaun UP.	25 Feet & 8	Hand pump (G.Bank)	0.2 micron gm/l*
35.	C:Hajjatpur,T:Dataganj Budaun,UP.	55 Feet & 7	Hand pump (G.Bank)	0.01 micron gm/l
36.	V:Sherpur,T:Tehsil, Budaun UP.	25 Feet & 8	Hand pump (G.Bank)	0.01 micron gm/l
37.	V:RampurNawada B:Jaitipur SPN,UP.	35 Feet & 8	Hand pump	0.01 micron gm/l
38.	V:Lalpur,T:Dataganj Budaun UP.	25 Feet & 7	Hand pump (N.Ganga)	0.05 micron gm/l*
39.	V:PurnaBenda T:Dataganj Budaun UP.	25 Feet & 8	Hand pump (G.Bank)	0.05 micron gm/l
40.	V:Harrampur,T:Dataganj Budaun UP.	25 Feet & 7	Hand pump (G.Bank)	0.05 micron gm/l
41.	V:NaglaDehatMali B:Jaitipur,SPN,UP	50 Feet & 8	Hand pump (G.Bank)	0.01 micron gm/l
42.	V:Baripasiddayapur B:Jaitipur ,SPN,UP.	35 Feet & 8	Hand pump (G.Bank)	0.02 micron gm/l*
43.	V:Dabhaura,B:Jaitipur SPN,UP.	35 Feet & 7	Hand pump (G.Bank)	0.01 micron gm/l
44.	V:Pahadpur,B:Jaitipur SPN, UP.	40 Feet & 7	Hand pump	0.01 micron g/l
45.	V:Marena,B:Jaitipur, SPN,UP.	55 Feet & 7	Hand pump (G. bank)	0.1 micron g/l**
46.	V:Antoo Gautia,B:Jaitipur SPN, UP.	40 Feet & 7	Hand pump (N.Ganga)	0.01 micron gm/l
47.	V:Azmabad,B:Jaitipur SPN,UP.	40 Feet & 7	Hand pump	0.02 micron gm/l*
48.	V&P:GRN,SPN,UP.	40 Feet & 8	Hand pump	0.02 micron gm/l*
49.	V&P: GRN,SPN,UP.	Stagnant water & 9	Pond	0.1 micron gm/l*
50.	V:Dhublakarimnagar B:Jaitipur,SPN,UP.	40 Feet & 8	Hand pump	0.02 micron gm/l*

Dangerous limit & drinking level of arsenic according to BIS, ICMR & WHO: 50 Samples.

S. No.	Arsenic value	No. of samples	%age	BIS&IC MR	WHO
1.	0.01	16	32	YES	YES
2.	0.02	10	20	YES	SUSPECTED
3.	0.05	11	22	YES	NO
4.	0.1	06	12	NO	NO
5.	0.2	06	12	NO	NO
6.	0.4	01	02	NO	NO

In 50 samples, 16 samples were found in normal limits (0.01 micron gram per liter) which were permissible for drinking to human and animals, 10 samples were in 0.02 micron gram per liter, suspected according to WHO but permissible limit according to BIS & ICMR in India. All the 24 samples (48%) were found beyond its limits. This should be completely prohibited by consumers. This was also not good for agricultural purposes e.g. Ganga water etc.

Conclusion

Water is the main problem of the world. According to WHO ideally drinking water should not contains any micro-organisms known to be pathogenic. It should be free from any micro-organism. The quality of water can be tested by total coliform counts & others methods are used for bacterial count and identifications. If their count is more than 10/ml, then this is not good for health purposes. In Uttar Pradesh mainly district Shahjahanpur & Budaun, many village lies near Ganga river belt where water level is easily available at 15 feet to onwards but not fit for drinking because at this level water have many types of impurities like turbidity, hardness, pH, alkalinity, fluorine, arsenic and so many heavy metals which are harmful for human beings as well as animal and

even plants also those irrigated by polluted water or Ganga river water near from it. If people use these arsenic amount rich water for a prolong time they may cause cancer like symptoms. Animals may suffer from low production of milk and bone deformation. So, avoid this arsenic rich amount of water in daily life and people must use arsenic filtered water. Arsenic is lipophilic in nature and easily combines with fat in our body. The drinking water for human being must be free from any fluoride. In UP, their levels are so high in many districts. This is very important issue for Government of India, how to get rid of this huge problem and how to avail pure and safe water to all consumers. In UP, mainly districts Shahjahnpur and Baduan water source was mainly hand pump and ponds or river for domestic animals. 120 feet was the highest level of hand pipe for domestic use and drinking purposes in these two districts. Few village of Tehsil Tilhar, block jaitipur & Tehsil Jalalabad (Shahjahanpur) and few village of tehsil and block Dataganj (Baduan), water level at 40 feet were found questionable for drinking and animals use but peoples used these contaminated water due to lack of facilities, purification and proper sanitation of water. Many villages who located near Ganga River, water had more turbidity and many types of impurities in the form of toxic elements were found. In Garhia Rangeen and its adjacent village's water were also questionable because water changes its color within few minutes. Yellow colors of water do not have any health hazards but many people were not found good in health. The reason for become yellowish of water, could be nearest of river basin or water level. The main health problems were found gastric as well as stomach; some complains hydrocoel, headache, weakness, anemic patients, dizziness, vertigo, whitish hairs

common in adults and young peoples in local areas. Due to high contamination of suspended particle and other heavy metals which were found in this particular area. Muscular cramp, Diabetes mellitus, Diabetes insipid, hypertension, weakness, anemia, and weight loss and dentition problem were more common in many peoples. If water problem will be solved there than peoples may be get rid of such type's problems in future otherwise result may be fatal. The one main cause of contaminated water could be there, because of high fertilizers, pesticides and insecticides used by farmers in these areas for agriculture and cultivation of vegetable for high production. These chemical percolates in underground water and may be ultimately contact to consumers through hand pipe and bore wells. There was no any drainage or waste water system in these villages. This water ultimately goes in nearby ponds, these contaminated water drinks many cattle. Fisheries were also grown in these contaminated ponds which may contain heavy metals like arsenic, fluoride, lead and mercury. These heavy metals are so toxic to human health beyond its limits. Arsenic levels were found remarkable in many places of both districts.

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