

All you need to know about

ARSENIC

Science For Poets

Research Team:

Akshaya Zachariach

Chaitrali Bhide

Gita Upmale

Shipra Koyal

Sreemoryee Roy Choudhury

Facts

- Inorganic arsenates have a much higher acute toxicity than organic arsenates
- The lethal dose of Arsenic for adults is 70-200 mg or 1 mg/kg/day
- The EPA standard for Arsenic level in drinking water is 10 ppb(parts per billion)
- People exposed to As in drinking water have reduced immune response to H1N1 and are at a higher risk of serious illness/death
- 80 million people worldwide consume between 10-50 ppb of Arsenic in drinking water of which 2000 people are detected with bladder cancer (only)

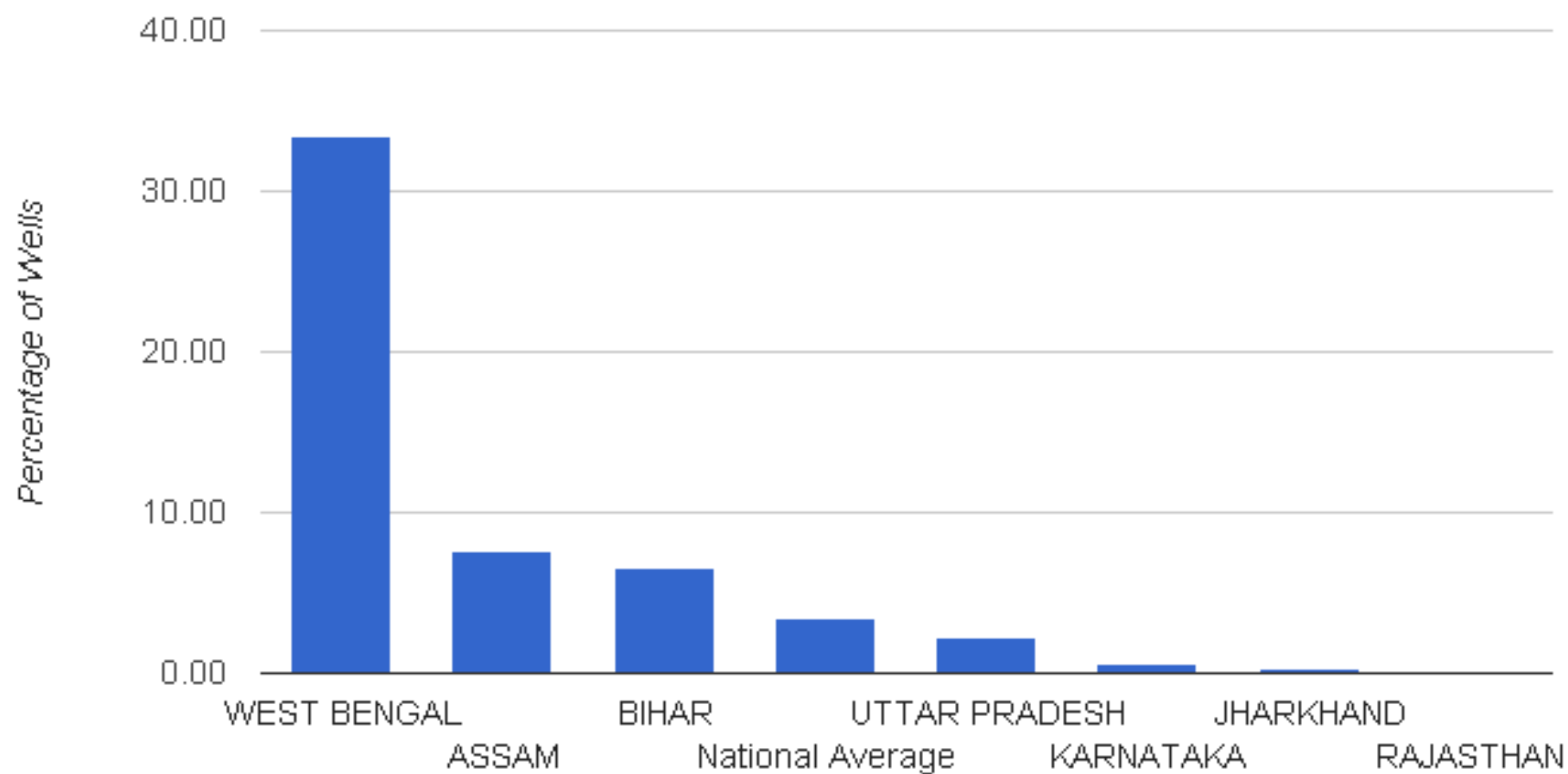
Where is Arsenic used?

- Agricultural: pesticides, animal food(disease prevention), herbicides, wood treatment, insecticides
- Medicinal: was used to treat syphilis, trypanosomiasis, has been used to treat cancer(As_2O_3)
- Industrial: Car batteries(alloyed with lead), laser diodes, LEDs,
- Military: WW-I, Vietnam War

Where is Arsenic found?

- Can be found as a Sulphur compound, or metal compound, or in its pure metalloid-crystalline state
- Ground water (Ganga, Brahmaputra delta), soil (Bihar, UP, WB, GJ, AP, ArP, Assam, CH, DL, JH, KA, MP, Manipur, Nagaland, PJ, Tripura), air, volcanic ash
- Concentrated in leafy vegetables, rice, apples, grape juice, seafood
- Side product of Copper purification
- Mines; smelter dust – Copper, Gold, Lead

Arsenic Contamination in Wells in India (Apr 2012)



Arsenic Contamination in Karnataka

- The Department of Mines and Geology found high levels of arsenic(carcinogen), 27 times its permissible level, in the water well of **Wandali village** in Karnataka's **Raichur** district.
 - i. A groundwater study by UNICEF, completed in May this year, also found arsenic in several villages of Raichur. This is the first time arsenic contamination has been detected in southern India.
 - ii. The majority of the villages surveyed were in the Hutti-Maski schist belt. (Schist is metamorphic rock having laminated, flaky parallel layers of micaceous minerals) contain arsenic-rich minerals like arseno **pyrite (Arsenopyrite - 46% arsenic)**. Three active gold mines in the region seem to be the probable source of contamination. **Hutti Gold Mines** operates all the three mines in Hutti, Hira-Buddini and Uti villages.

- i. Water samples from Nagaldinni village in **Manvi** had **0.668 ppm** (parts per million) arsenic against **permissible 0.01 ppm**. Whereas, Water samples in **Maski** showed **0.139 ppm** of arsenic, according to the Department of Mines and Geology's report
- A study conducted near the gold mining area in the **Mangalur** concluded that the level of arsenic found in the ground water in the region is 303 ugL^{-1} , 30 times higher than the World Health Organisation (WHO) norm of 10 ugL^{-1} . Abandoned gold mines are a contributing factor to arsenic contamination.

How does it affect the human body?

- Initial symptoms – headache, confusion, severe diarrhea, drowsiness, gangrenous blisters on palms and soles
- Developing symptoms – cardio vascular disease, night blindness, vitamin A deficiency, convulsions, leukonychia (change in fingernail pigmentation), Anemia, Hyperkeratosis(thickening of skin)
- Acute poisoning – diarrhea, vomiting, blood in urine, cramping muscles, hair loss, stomach pain, convulsions
- Main organs – Lungs, skin, kidneys, liver
- Brain – Coma – Death

Arsenic Trioxide (As_2O_3)

- Arsenic Trioxide is 500 times more toxic than pure Arsenic
- 50,000 tones is produced annually
- Major cause for water contamination – lung cancer, bladder cancer, skin cancer, reproductive problems
- Permissible exposure limit in breathing zone(air) is 0.010 mg/m^3

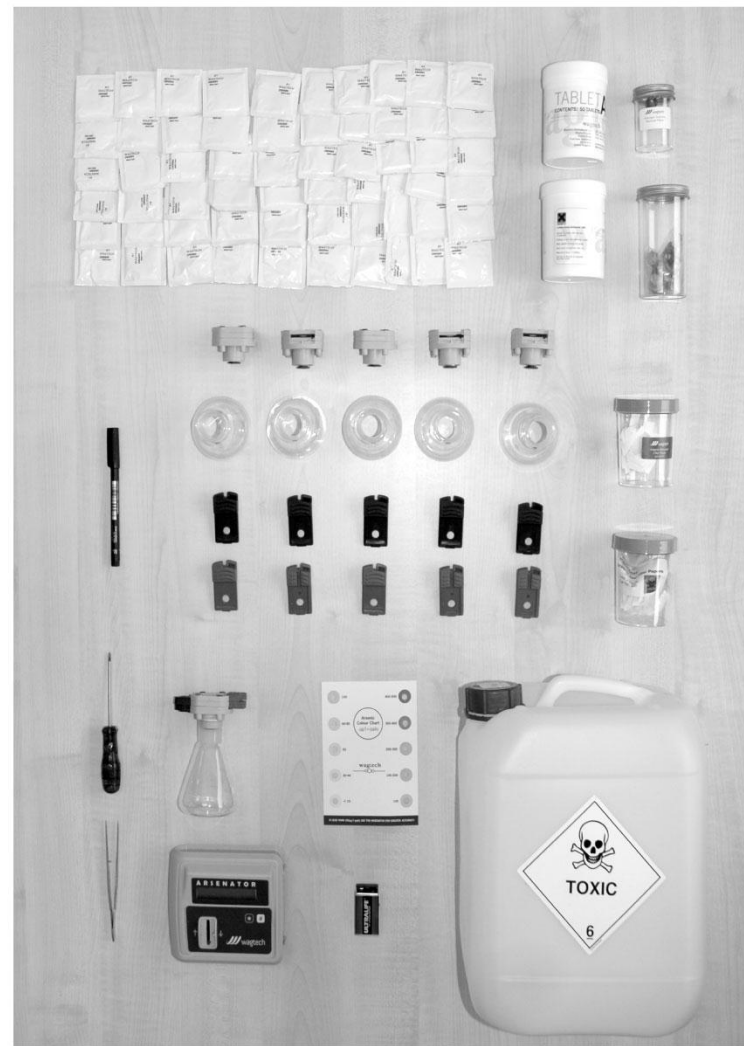
Organizations dealing with water contamination

- Arghyam - works primarily through partnerships – with Government, NGOs and various types of institutions.
http://www.arghyam.org/about_us
- Water Canary - is working to eliminate the organizational and financial barriers that keep real-time water quality information out of reach. <http://www.watercanary.com/about/>
- Everything About Water - is India's leading knowledge and marketing solutions provider in the area of water and wastewater management. <http://www.eawater.com/about-us.html>
- Jal Bhagirathi - an Alwar-based NGO to promote and advocate for participatory water management paradigm as a national necessity.
<http://www.jalbhagirathi.org/history.html>

Current Testing Processes

- Use of *bacillus subtilis* to test arsenic instead *e.coli* - turns green when levels are safe
- ARSOLux-Biosensor kit uses *E. coli* to detect Arsenic through luminescence (Bangladesh)

A collection of laboratory equipment including a 96-well plate, a 24-well plate, a microplate reader, a pipette, a rack of tubes, and a marker.



ARSENIC TESTING KIT

for low-cost, quick and accurate testing of Arsenic in water

Tel/Fax: +91 20 27274958

Cell: +91 9371015199

E-mail: prerana.lab@gmail.com

The Arsenic Testing Kit designed and manufactured by Prerana Laboratories is unique in many ways.

It is one of the most economical Arsenic analysis kits available. Yet, it is one of the quickest, lightest and most simple Kits for field-testing of Arsenic.



Specifications:

- 1) No. of tests: 100
- 2) Range / Sensitivity: 10, 50, 100, 300, 500 ppb
- 3) Reaction time: 11 minutes
- 4) Test type: Test Strip colour comparison
- 5) Weight of Kit: 400 gms.
- 6) Dimensions (cm): 13 (L) x 12 (B) x 4.5 (H)

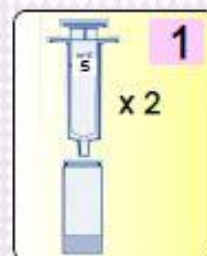
Notable features:

- 1) Small dimensions -
Kit fits in your pocket! Small box contains everything required for spot-analysis. Easy to stock.
- 2) Light-weight Kit (only 400 gms.) -
Easy to carry and transport. Huge saving in freight costs for bulk requirements!
- 3) Reaction time only 11 minutes, yet a simple hassle-free test method -
Huge saving of time. Save upto 32 hours* per Kit! Testing procedure innovatively designed to avoid loss of precious gas during crucial initial stages of the test.
- 4) Safe to handle -
Very controlled, stable reaction.
- 5) All Reagents in safe powder form -
Conventional reagents with unique technology for quick tests.
- 6) 100 tests in 1 compact kit.
Test sensitivity includes 2 critical values of 10 ppb and 50 ppb.
- 7) Tackles sulfide interference upto 3 ppm -
No false results!
- 8) Includes 2 free sample sachets** of our unique product for household removal of Arsenic from 15 Litres of contaminated drinking water -
Quick and easy do-it-yourself remedy available for Arsenic contamination problem in drinking water. Check results yourself!
- 9) Kit packed with all above features, yet extremely economical -
Great value for money!

*Compared to Arsenic Test Kits with basic reaction time of 30 minutes.

**For a limited period. Available for sale separately.

Testing method



Take 10 ml sample in Reaction Tube using syringe.



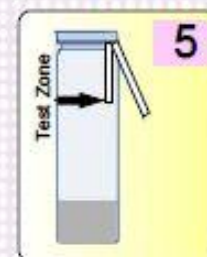
Add 1 quarter spoon Reagent ARSENIC-1 and swirl. Wait for 1 minute.



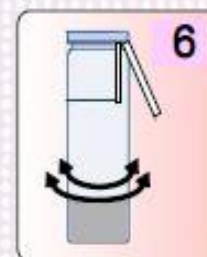
Add 1 flat spoonful Reagent ARSENIC-2 and swirl.



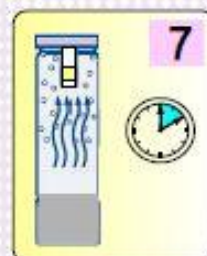
Keep a Test Strip ready. Add 1 flat spoonful Reagent ARSENIC-3. DO NOT SWIRL.



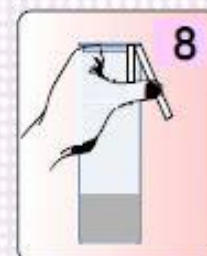
Immediately place the Test Strip in the Reaction Tube and put cap tightly.



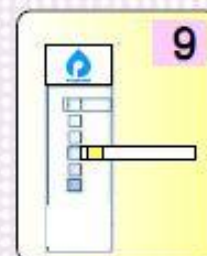
Swirl and mix for about 5 - 6 seconds.



Let the Reaction Tube stand for 10 minutes. Swirl twice in between.



Hold the Test Strip with thumb and remove the cap of Reaction Tube. Carefully remove the Test Strip.



Match the colour of Test Zone on Test Strip with the given colour chart. Read Arsenic content on chart.