

New allies in fighting arsenic

Plants and bacteria may join the forces fighting the arsenic crisis in the Bengal Delta, says S. Ananthanarayanan

Arsenic in ground water in Bangladesh and parts of West Bengal is poisoning thousands. An estimated 36 million people in the region are drinking contaminated water and 150 million are at risk. Identifying and marking the contaminated wells and purifying water have become priorities.

Something about Arsenic

Arsenic occurs in nature as a yellow mineral, arsenic sulphide and it gets its name from arsenikon, Latin for yellow pigment. In another form, of white arsenic, or arsenic oxide, it is extremely poisonous, with symptoms that could be confused with those of many other illnesses. And the arsenic itself, until recently, was difficult to detect after the death.

The single deadly dose is 125 milligrams, which is just a fourth of the dose for mercury. But more deadly, slow poisoning begins with much smaller doses and, according to a document from Harvard University, a person who drinks water with 0.3 mg in a litre will soon die! But at levels in between, arsenic poisoning progressively causes skin ulcers, lung and stomach illness, bladder and blood disease, gangrene and cancer.



How does arsenic work?

The arsenic atom has a quality of binding very strongly to groups of atoms that contain sulphur. Now, the body chemistry is regulated by enzymes, which are very finely sculpted proteins that are able to facilitate specific processes, by virtue of their being structured just so. And most enzymes contain one or more sulphur atoms.

When arsenic binds to the sulphur in the enzyme, this upsets the sensitively balanced enzyme structure and renders it ineffective, leading to the many symptoms of different organs not functioning.

Arsenic in well water

Arsenic in the Bangladesh/Bengal region, the coastal floodplain of several rivers, is believed to arise from heavy metals washed down by rivers and deposited with the silt. The bulk of 'low-bored' wells in the region are thus affected, with arsenic levels above the prescribed level 0.05 mg/litre, or about 50 parts in a billion.

A major initiative taken is first to identify and mark the contaminated sources. Identification is done with portable lab kits. But as the results are not reliable, a large proportion of contaminated wells get labelled as arsenic free.

The Swiss Federal Institute for Environmental Science and Technology has now developed strains of bacteria (E coli) that give visible indications of arsenic levels. Genes that produce colours are introduced into the region of the DNA that controls resistance to arsenic. The bacteria then begin to glow when they meet arsenic. Strips of paper with the bacteria embedded thus become arsenic dipsticks and enable easy identification of bad wells.

Ferns that clean water

Edenspace Systems Corporation in Dulles, Virginia, have found that a species of fern called *Pteris vittata* will suck arsenic out of tainted water. The plants reduce the concentration to below the prescribed US safety limits in less than a day.

This procedure, called phytofiltration, may become the method to scrub water free of arsenic, once developed to work in large quantities. The arsenic extracted can be squeezed out of the plants by presses, and put to industrial use. This would also eliminate waste disposal.