IUPAC Project: Arsenic Contamination and Remediation in Bangladesh

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GROUND WATER IS CONTAMINATED WITH ARSENIC IN MANY PARTS OF THE WORLD

South East Asia has a massive Arsenic Contamination
33
Arsenic Contamination showing > 50 ppb

%age of Tube-wells
- 80% to 100%
- 60% to 80%
- 40% to 60%
- 20% to 40%
- 0% to 20%
- 0%

Patient Identified

59 out of 64 Districts are affected
Thousands of patients seen

8-12 million tube wells exist

Case-Study: Bangladesh Extent of Contamination

Tragedy: “Biggest Mass Poisoning in the History of Mankind”
Introduction to Arsenic Toxicity

Occurrence: Inorganic Toxic Arsenic occurs in air, water, medicine, food & Soil

The commonest is contamination of drinking water

~30% of Exposed subjects develop arsenicosis

Late Stage Complications include
Various types of cancers (skin, bladder, liver and lungs)
Diabetes, adverse reproductive outcomes, etc
How Did We Get to the Massive Arsenic Contamination?

- Search for microbiologically pure water in the 1970s
- Bangladesh alone 10-12 million tube wells were dug
- Digging into the aquifer rich in geologic arsenic
- Mechanism: microbially mediated reductive labilization of As
Challenges in Arsenic Mitigation

- Lack of reliable field tests for As
- Need for cheap removal technologies
- Options for alternative water supply expensive (surface water, deep wells)
- Variations among neighboring wells
- No currently known cure for arsenicosis
Chemical Properties of Interest

- Analysis in water by colorimetry (classical method), neutron activation, polarography, atomic absorption and emission spectroscopy
- Formation of organoarsenes
- As(III) 60x more toxic than As(V)
Removal of Arsenic from Water by Conventional Technologies

- Coagulation
- Sorption to activated alumina
- Ion Exchange with strong-base anion exchange resins
- Reverse osmosis
Removal of Arsenic from Water: Emerging Technologies

- Fe oxide as absorbent
- In situ remediation using passive reactive barriers
- Bioremediation with chemical preparation
- Aquifer oxygenation
Questions for Discussion

- What new scientific knowledge is needed?
- What is the role of government?
- What economic incentives exist locally?