WaTER Center Research – Arsenic Mitigation

A 2008 World Health Organization (WHO) report cited arsenic (along with fluoride) as a critical drinking water issue that causes severe health issues at levels above its drinking water standard of 10 μg/L. In many areas, arsenic occurs naturally in groundwater at concentrations well above the WHO standard – as high as 3,000 μg/L. In Southeast Asia, arsenic impacts at least two, ten and thirty-five million people in China, Vietnam and Bangladesh/West Bengal, respectively, causing liver and skin cancer. In addition, arsenic consumption by children can reduce intelligence and cause neurotoxic damage.

While numerous studies have demonstrated arsenic removal using iron oxide coated sand, the arsenic removal capacity of different types of iron oxides coated on sand has not been widely studied. The different iron forms vary in composition, iron valence, crystalline structure, and point of zero charge (PZC). These characteristics determine the effectiveness of the material to adsorb arsenic. Differences in surface area have also been shown to have a profound impact on the arsenic adsorptive capacity, and can be seen in proprietary materials. However, these commercially available materials can be quite costly, even for communities in the U.S. For the 1.4 billion people worldwide who live on $1.25/day, this technology is out of reach. Thus, there is a pressing need for low cost, sustainable water treatment technologies for arsenic removal that utilize locally available materials, where possible.

Listed below are a few of the current research topics related to arsenic mitigation being pursued by WaTER Center:

- Mechanisms of arsenic adsorption onto commercially available and emerging filter medias are being investigated. This includes exploring the effectiveness and viability of these medias both in areas of the developing world that are impacted by arsenic contamination (e.g. Cambodia), and in smaller communities in the US with limited financial resources.
- Various iron-based materials are being created and their potential to remove arsenic from drinking water is being tested.
- Different types of bone char are tested for their capacity to remove arsenic from ground water. As part of this research, ideal charring conditions are measured and the chemistry of the interactions is studied.
- Community education and technology implementation methods are being studied to determine locally effective methods.
- Various materials and combined media are tested for their potential to remove both microbial contaminants and arsenic.

Sustainability requires technical efficiency, economic and social viability, and minimum environmental impact across the life cycle. While motivated by challenges in remote villages of developing countries, research results will also benefit those living in rural communities of the United States impacted by arsenic.