Arsenic Removal From Drinking Water Systems Using a Novel Hybrid Sorbent

VEETech, P.C.

942 Millbrook Avenue, Suite 6
Aiken, SC 29803
Telephone: 803-641-0085
http://www.veetechpc.com

Environmental Problem

The presence of dissolved arsenic in contaminated groundwater has emerged as a major concern for drinking water supplies on a global scale. Sources of dissolved arsenic in groundwater include natural geochemical contamination through soil leaching, combustion of fossil fuels, and inorganic arsenic, which occurs as As(III) or As(V) in drinking water and poses a great threat to human health. Exposure to higher levels of arsenic in drinking water can lead to thickening and decoloration of skin; nausea and diarrhea; decreased production of blood vessels; and skin cancer and tumors of the bladder, kidney, liver, and lung. As a result of the problems associated with arsenic exposure, EPA passed a regulation to lower the arsenic concentration from 50 ppb to 10 ppb in drinking water. More than 4,000 water utilities serving approximately 20 million people will need corrective action to comply with the new regulation.

SBIR Technology Solution

With support from EPA's SBIR Program, VEETech, P.C., in collaboration with Lehigh University, developed a family of polymeric-inorganic hybrid sorbents, known as HIX, that can selectively capture all forms of arsenic and other co-contaminants from drinking water. HIX can be used in a fixed-bed configuration without the need for any pre- or post-treatment. HIX also can be regenerated and reused for many cycles of operation, thus yielding a very low life cycle cost of treatment. The regenerant can be stabilized and disposed of as nonhazardous waste. HIX is accepted by EPA for the simultaneous removal of arsenic and multiple co-contaminants from drinking water.

HIX exhibits the following characteristics for removal of arsenic in drinking water: (1) excellent mechanical strength and attrition resistance; (2) selectivity towards both As(III) and As(V); (3) requires no pre- or post-treatment (e.g., pH); (4) does not alter the electrolytic quality of treated water; (5) generates no fines or pressure drops during long-term column operation; (6) can treat up to 40,000 bed volumes of water per cycle and can be regenerated up to 20-30 cycles of operation; and (7) can remove multiple contaminants such as radium, uranium, and perchlorate along with arsenic.

A majority of the small- and medium-sized drinking water utilities require an arsenic removal system that is easy to operate, low cost, needs minimal operator attention or training, is forgiving towards fluctuations in feed compositions, does not require frequent regeneration or disposal, and requires minimal start-up time. A fixed-bed HIX arsenic removal system meets all of these desirable attributes and is ideal for use by the small- and medium-sized utilities that are most affected by EPA's 10 ppb standard for total arsenic.

Although the primary focus of the HIX technology is the removal of arsenic from drinking water, it also can be selectively applied to separate a host of heavy metal contaminants from other aqueous streams, such as fly ash and coal pile leachate from electric generating stations, and wash water and drainage from mining operations. Both of those streams contain several heavy metal contaminants that will require treatment to meet increasingly stringent discharge standards. In addition, this system will remove natural uranium from drinking water sources. The technology can be configured as

HIX, developed by VEETech, P.C., is a family of polymeric-inorganic hybrid sorbents that can selectively capture all forms of arsenic and other co-contaminants from drinking water.

a permanent or mobile system. The basic components are one or two columns and a small number of tanks and pumps. The HIX system also can be retrofitted as a polishing unit downstream of the existing water distribution system.

Commercialization Information

Based on the results of pilot studies, EPA selected VEETech's HIX technology for demonstration at a site in Lake Isabella, California. This will be the first full-scale commercial HIX system built. Commercialization of the HIX-based fixed-bed arsenic removal technology can benefit the numerous drinking water utilities affected by arsenic concentrations in excess of the maximum concentration limit. The simplicity, versatility, and cost of the HIX technology are expected to play a significant role in the environmental compliance of drinking water suppliers.

The technology has very good export potential to the countries suffering from acute arsenic toxicity. The ability of HIX to simultaneously remove arsenic and other co-contaminants (e.g., uranium, radium, chromium) from aqueous sources is beginning to garner attention and may set this media apart from its competition.

Company History

VEETech, P.C., is a certified 8a organization with locations in Cary, North Carolina; Aiken, South Carolina; and Philadelphia, Pennsylvania. Founded in 1996, the company provides environmental engineering, consulting, construction, and remediation services to a variety of clients, including the U.S. Army Corps of Engineers, North Carolina Department of Transportation, South Carolina Department of Health and Environmental Control, Georgia Power Corporation, and Lucent Technologies, Inc. VEETech, also has created a technological niche in implementing cost-effective pollution control technologies, such as BIOSORPTION®, an advanced form of biofiltration that treats a wide variety of volatile organic compounds.

SBIR Impact

- The presence of dissolved arsenic in contaminated groundwater has emerged as a major concern for drinking water supplies on a global scale.
- VEETech, developed a family of polymeric-inorganic hybrid sorbents, known as HIX, that can selectively remove all forms of arsenic and other co-contaminants from drinking water.
- A fixed-bed HIX arsenic removal system is ideal for use by the small- and medium-sized utilities that are most impacted by EPA's 10 ppb standard for arsenic.
- Based on the results of pilot studies, EPA selected VEETech's technology for full-scale demonstration at a site in Lake Isabella, California.