Adsorbents For Efficient Capture Of Heavy Metal Ions And Arsenic From Water

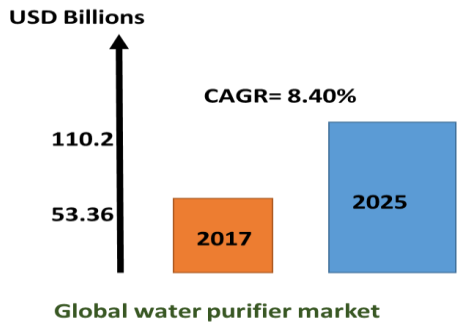
THE INVENTION

Using a novel method of preparation, KFUPM researchers have developed layered nanostructured adsorbents for removing metal ions from water.

MARKET NEED

An important environmental problem is the pollution of water, and there is an urgent need for the development of new kinds of materials that can effectively remove toxic metal ions from water. Trace amounts of arsenic in drinking water are believed to be responsible for skin, liver, lung, and bladder cancers, as well as immune disorders, neurological diseases, and functional disturbances in the cardiovascular and nervous system. Recently, the World Health Organization (WHO) and the United States Environmental Protection Agency have fixed the maximum concentration of arsenic in drinking water at 0.010 mg/L. Additionally, the presence of toxic heavy metals, such as Hg2+, Pb2+, and Cd2+, in water is a major environmental concern, due to harmful effects of heavy metals on humans and other species. The development of effective processes to remove (toxic) heavy metals and arsenic from water, bringing such metals down to no more than trace levels, e.g., < 5, 2, 1, 0.5, 0.1, or 0.01 ppb, is a great challenge. Currently, there are presently no commercially available one-step systems and/or absorbents for the simultaneous removal of toxic heavy metal ions and the poisonous metalloid arsenic from drinking water. Therefore, a need exists in the market for of technologies that can detect and remove toxic metal ions.

The global water purifier market is expected to reach US$110.02 bn by 2025 and is expected to grow at a CAGR of 9.00% between 2018 to 2023[1]. The key driver for this market is the rising demand for clean and healthy water for consumption.



Global water purifier market

COMPETITIVE ADVANTAGE

This technology offers the following features:

- Excellent chemical stability
- Simple one-step preparation method
- No heating required
- Effective within a wide pH range (1 to 9)
- The distribution coefficient (K_d)value for highly toxic ions reaches ~10^7 mL/g
- The order of selectivity for the tested ions is as follows: Co^{2+}, Ni^{2+}, Zn^{2+} < Cd^{2+} ≪ Pb^{2+} < Cu^{2+} < Hg^{2+} < As^{5+}
- Rapid removal of Pb^{2+} and As^{4+} ions from ppm levels to trace levels of ≤1 ppb

MARKET READINESS

This KFUPM technology is validated at laboratory scale (Technology Readiness Level 3). Experimental results indicate that the adsorption of all the highly toxic metal ions from aqueous solution was exceptionally rapid and highly selective, with more than 95% removal achieved within 30 min including a maximum adsorption capacity of ~500 mg/g.

PATENT PROTECTION

This technology is filed in the US Patent And Trademark Office with application number 16363353. The patent application is owned by King Fahd University of Petroleum & Minerals (KFUPM).

LOOKING FOR A DEVELOPMENT PARTNER

KFUPM seeks an industry partner to validate this technology in relevant environment and ultimately for possible commercialization.

ABOUT KFUPM

King Fahd University of Petroleum & Minerals is a leading educational organization for science and technology. KFUPM Innovation & Technology Transfer is the IP management and technology licensing office tasked with taking innovation from lab to market place.

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1 https://www.transparencymarketresearch.com/pressrelease/water-purifier-market-2017-2025.htm