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Engineering Amorphous Titanium (Hydr)Oxides Incorporated into Point of Use Activated Carbon Block Filter for Simultaneous Removal of Metallic and Oxo-Anions Removal from Drinking Water

Background

Arsenic is classified as a Class-A human carcinogen, and occurs widely in ground and surface waters across the globe. Long-term exposure to arsenic-contaminated water has been linked to skin, kidney, liver, and bladder cancers. In addition to arsenic, other metals (e.g., chromium, vanadium, tungsten, selenium, manganese, lead) commonly co-occur with arsenic and also pose significant health risks. Over 40 million people in the U.S. have private wells and millions of others served by municipal water suppliers have water quality problems, and point-of-use (POU) treatment devices provide homeowners with strategies to treat water to higher levels of safety. However, few of these POU devices are designed to remove mixtures of metals that pose health risks. Those that remove metals waste >75% of the incoming water.

Activated carbon (AC) treatment is widely used to remove organic pollutants from water, and AC is used to make porous carbon block (CB) cartridges in POU systems. These porous carbon blocks add functionality to remove pathogenic particles (e.g., bacteria, protozoa). However, carbon block does not remove mixtures of dissolved metals in water, and is not designed to remove arsenic and other oxo-anions from water.

Invention Description

Researchers at Arizona State University have developed a method of fabricating amorphous or crystalline titanium hydroxide (THO)-impregnated carbon block to provide superior arsenic removal capability and a stable coating layer of THO. This method involves retrofitting ordinary carbon block with an impregnation technique that enables arsenic or other similar oxo-anions removal through an adsorption process. The newly modified carbon block serves as an effective and efficient POU system to address the need for arsenic removal from contaminated waters. Other industrial applications of THO impregnated CB exist where metal removal from water is needed.

Potential Applications

- Rural water treatment (removal of toxic metals)
- Removal of arsenic, vanadium, tungsten, selenium and others from tap water
- Point-of-use (POU) system for household water treatment

Benefits & Advantages

- Compact (can be used in existing cannisters or housing)
- Easy to install and replace
- Significantly high adsorptive capacity for arsenic removal
- Allows incorporating amorphous THO and coating of CB pores without impairing organic removal capabilities
- Can be used at the household level for arsenic and other similar oxo-anions removal from water without any waste stream

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