

MULTIFUNCTIONAL WATER FILTERS FOR METAL AND OXYANION REMOVAL

Tech ID: 32969 / UC Case 2023-037-0

PATENT STATUS

Patent Pending

BRIEF DESCRIPTION

Widespread metal and oxyanion contaminants in groundwater due to industrial activities, land use, and natural geology have resulted in a scarcity in potable water in California and worldwide. These contaminants can be carcinogenic and highly toxic at low concentrations, presenting an urgent need for innovative water purification technologies. However, existing technologies for treating groundwater and brackish water are often energy intensive, non-selective, or not suitable for recovery. Therefore, advances in oxyanion removal technologies could significantly improve the potential of safely using groundwater as an alternative drinking water resource.

To address this opportunity, researchers at UC Berkeley have developed a novel multifunctional water filter that exploits the high removal efficiency of toxic metal ions and oxyanions by using two-dimensional (2D) molybdenum disulfide (MoS₂) nanosheets. MoS₂ exhibits multiple removal pathways towards oxyanions such as Cr (VI) and Se (VI), including adsorption, reduction, and physical filtration. The multifunctionality of the MoS₂ filters allows in-situ detoxification of the oxyanions, which could greatly reduce the pressure on waste/waste stream treatment. Moreover, MoS₂ filters can be integrated into existing water treatment processes (e.g., low-pressure micro/ultrafiltration and adsorption). This integration allows for the treatment of a wide selection of non-traditional water resources, including groundwater and industrial wastewater, and also reduces the costs of the additional steps required for the removal of toxic metals in traditional water treatment processes.

The innovation is more efficient, and more selective in targeting oxyanion species, in comparison to currently available technologies, such as reverse osmosis, nanofiltration, adsorption, ion exchange, and coagulation-precipitation. This novel multifunctional filter could potentially reduce operational costs, simplify maintenance, and minimize the impacts of environmental factors compared to other oxyanion treatment technologies.

SUGGESTED USES

- » Water purification
- » Metal removal and treatment
- » Waste stream detoxification
- » Point-of-use household treatment systems
- » Recovery of precious metals

ADVANTAGES

Advantages of MoS₂-based water filters compared to existing state-of-the-art oxyanion removal technologies include:

- » reduce sludge production compared to coagulation or precipitation-based technologies
- » maintain high performance
- » reduce the impacts of competitive ions often found in ground waters, which decrease the performance of ion exchange/adsorption technologies

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OTHER INFORMATION

KEYWORDS

membranes, filters, MoS₂,
molybdenum disulfide, heavy metal,
oxyanion

CATEGORIZED AS

- » **Environment**
- » Remediation
- » **Engineering**
- » Engineering
- » **Materials & Chemicals**
- » Nanomaterials
- » **Nanotechnology**
- » Materials

RELATED CASES

2023-037-0

- » higher adsorption capacity
- » much longer lifetime and/or backwashing cycles
- » can be used under various settings such as membranes or adsorptive columns

This invention offers:

- » Flexibility
- » Simple operation
- » Cost-effectiveness
- » High compatibility
- » Adaptability for efficient removal of oxyanions such as Cr (VI) and Se (VI)

RELATED MATERIALS
