

Using Polysaccharide Aerogels to Filter Drinking Water Polluted by Industrial and Agricultural Waste

435

Million people take water from unprotected wells and springs.

144

Million people collect untreated surface water from lakes and rivers.

LACK OF CLEAN WATER

The lack of clean drinking water is a huge problem that plagues every country, world-wide. Even in developed countries, like the United States and Canada, pockets of communities and minorities remain without drinking water. In underdeveloped countries, the circumstances are worse. They are forced to drink water contaminated by industrial and agricultural waste for *survival*.

AFFORDABLE, ACCESSIBLE, CLEAN WATER

1

Fill

Fill your mesh bag with the AeroPure beads.

2

Soak

Then the AeroPure packet is soaked in the water, allowing the packet to remove contaminants in the water.

3

Squeeze

In order to regenerate the AeroPure beads, it must be placed in vinegar. Once the packet has been absorbed the contaminants. Squeeze the polluted substances out of the AeroPure beads.

4

Repeat

They can be reused 10 to 30 times with a < 1% decrease in absorption capabilities.

Cellulose

Cellulose is covered in hydroxyl (-OH) groups which are **amphiphilic**, meaning they are attracted to both water and organic compounds such as oils. By coating the aerogel with a silane coupling agent (such as MTES), it can be turned hydrophobic and oleophilic, such that it selectively **absorbs 99.4% of organic compounds** including oils, dyes, organic solvents, pharmaceuticals, and pesticides, without absorbing water. With a density of 0.04 g/cm³, 97.3% porosity, and a specific surface area of 26 m²/g, the cellulose aerogel has an adsorption capacity of 59 g/g for crude oil and 212.7 mg/g for dyes.

Alginate

Alginate is covered in both hydroxyl and carboxylate groups, and is typically obtained from brown seaweed. Apart from it being an anionic polymer, the addition of the carboxylate group gives the aerogel a **high affinity for heavy metal ions** such as lead (Pb²⁺), copper (Cu²⁺), and cadmium (Cd²⁺). With a density of 2.15 g/cm³ and a specific surface area of 419 m²/g, the alginate aerogel is able to **remove up to 99% of the ions** with an adsorption capacity of 415 mg/g for Pb²⁺, 126.82 mg/g for Cu²⁺, and 244.55 mg/g for Cd²⁺.

77x

Cost reduction for the average person living in Africa. With one pack of alginate beads costing \$2.63 and one pack of cellulose beads costing \$1.41, this equates to a 77x cost reduction for the average person living in Africa, compared to the price they would have to pay currently if their water was clean and drinkable.

- ✓ Biodegradable
- ✓ Low Toxicity
- ✓ Inexpensive