Removal of Pb Heavy Metal from Water Using Edible Marine Algae (Undaria pinnatifida)

Namkoong, Hannah (School: Tabb High School)

Water security is becoming a new challenge for many countries as industrial waste containing heavy metals is being disposed in bodies of water. Lead (Pb) is an extremely toxic yet common contaminant in wastewater. My research explores a marine alga called Undaria pinnatifida to create an inexpensive and disposable lead removal system. I grounded dry pieces of Undaria pinnatifida into 125 micrometers and mixed the algae powders into a 2% sodium alginate solution. Then, a 10 mL syringe was used to extract the homogenous solution and form drops and wires of alginate biomass into a 2.5% calcium chloride solution. Beads and wire were inserted into 100 ppm lead solutions to test for lead removal efficiency. Data analysis showed Undaria pinnatifida's maximum biosorption capacity to be 5 times greater than of activated carbon, the current lead removal solution, indicating its superior lead removal abilities. An increase in surface area by reducing the bead diameter or creating thin wire increases the hydroxyl radical and lead ion contact increasing lead removal efficiency. When solution temperature rises, faster Brownian motion of Pb ions in the solution increases biosorption on the algae's surface. I started with a piece of marine alga that absorbed almost no lead, but by activating its natural alginic acids to aid in biosorption through the immobilization process and controlling size, geometry, and temperature, I was able to remove 100% of the lead from water surpassing the efficiency of current lead removal methods.

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