Removal of Radioactive Strontium from Contaminated Water Using Novel Cost-Effective Biosorbents

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The negative environmental impacts associated with the reliance on fossil fuels for energy production has led to the growth of nuclear energy; however, nuclear power bears its own risks. Strontium 90, a byproduct of nuclear fission, may escape into waterways after a nuclear accident and pose a severe hazard to ecosystems. The purpose of this experiment was to determine whether biosorbents can be a reliable, and economical alternative to cation resin that is currently used to remediate strontium contaminated water. Spent coffee ground (SCG), Ulva lactuca, filamentous algae, and crushed crab shells were tested. In the experiment, strontium solutions were treated with the various types of biosorbents (cation resin as control), and an ICP-OES measured the resulting strontium concentration for each sample. The data from the experiment revealed that crab shell removed a significant percentage of strontium (90%) and has immense potential of emulating the performance of nuclear grade cation resin with modifications to the crab shell particles. A series of t-tests confirmed that the results were statistically significant (except SCG vs. Ulva lactuca). Crab shell was able to absorb strontium because the shell particles were treated with .1M HCl, which removed $CaCO_3$ and exposed the chitin-protein nanofiber complex of the crab shell. Physical capture played a major role in trapping strontium ions from the environment, but it is suspected that the exposure of carbonyl and amine function groups also contributed. Through the conclusions reached, further research should investigate the strontium absorption capabilities of other chitin-based crustacean shells and test crab shell's capability of removing other types of radionuclides from contaminated water.