Efficacious Phytoremediation of Rice and the Surrounding Environment from Arsenic and Lead using Nymphaea odorata

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Arsenic and lead contamination of rice and water is a worldwide health crisis with no current solution. Additionally, exposure to these chemicals poses the highest cancer risk ever found. Previous work by this investigator revealed metabolically inactive Nymphaea odorata filters effectively removed arsenic and lead from aquatic environments leaving no contamination and ultimately safe drinking water. The current study investigates the usefulness of metabolically active and inactive Nymphaea odorata in removing arsenic and lead from rice plants and surrounding irrigation water. Previously, this methodology was untested. The hypothesis states Nymphaea odorata will remove heavy metals from rice and surrounding aquatic solutions. Nymphaea odorata creates a concentration gradient external to the rice cell wall, thereby creating an efflux of previously absorbed ions and hyperaccumulating them through ion transport mechanisms. Six types of tests were run; arsenic and lead controls, rice co-planted with live Nymphaea odorata and exposed to arsenic or lead, and rice treated with dead Nymphaea odorata and exposed to arsenic or lead. Data collection included tests for pollution in rice, water, and Nymphaea odorata, both before and after exposure to contaminants. Rice exposed to arsenic was 99.98% phytoremediated, and rice exposed to lead was 91.55% phytoremediated. Water exposed to arsenic was 99.99% phytoremediated, and water exposed to lead was 99.9% phytoremediated. All differences were statistically significant. Co-plantation of Nymphaea odorata is an extremely effective heavy metal phytoremediator for rice and irrigation water, and can potentially ameliorate cancer risks posed from drinking and eating heavy metal contaminated foods.

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