

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.