

Title: Plants as a Resource for Identifying Rare Earth Elements (REEs)-Binding Proteins and Peptides for Bioengineering REE Mining Systems

Abstract:

Rare Earth Elements (REEs) are critical metals for modern electronics, green technologies, and defense systems. However, due to their dispersed nature in the earth's crust, frequent co-occurrence with radioactive materials, and similar chemical properties, acquiring and purifying REEs is both costly and environmentally damaging, restricting access to these metals. Plants could serve as resources for bioengineering REE mining systems. Although there is limited information on how REEs affect plants at a cellular and molecular level, some plants with high REE tolerance and hyperaccumulation have been identified. The purpose of this investigation is to identify REE Binding Proteins and Peptides from REE tolerant and hyperaccumulator plants (e.g. *Lemna minor* and *Phytolacca americana*) that could be used for bioengineering REE mining systems. We developed an imaging system to enable high-throughput detection of REE-uptake in plants and microbes. We are using this system to test REE-binding molecules identified from known REE-binding proteins orthologs from REE-tolerant and hyperaccumulator plants and the transcriptional response of these plants when grown in a REE solution. Absorbance and fluorescence assays are implemented for metal-binding and competence tests between REE subtypes and other metals like Ca^{2+} and Mg^{2+} . Our goal is to identify REE-binding molecules from plants and enhance their selectivity to individual REE or REE subtypes for future development of REE mining systems.