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BIOACCUMULATION AND PHYTOTOXICITY OF IONIC RARE EARTH ELEMENTS (CERIUM, NEODYMIUM, SAMARIUM) IN LEMNA GIBBA

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Rare earth elements (REEs) are increasingly used in modern technologies, raising concerns about their release into aquatic environments and subsequent transfer through food webs. This study investigated the response of the floating macrophyte *Lemna gibba* to three ionic REEs (Ce, Nd, and Sm), focusing on phytotoxicity, uptake, and bioaccumulation. Plants were exposed to contaminated water for eight days, during which REE concentrations in the growth medium and plant biomass were monitored to establish a complete mass balance. The highest non-toxic concentrations were 0.8 mg L⁻¹ for Ce, 1.8 mg L⁻¹ for Nd, and 7.7 mg L⁻¹ for Sm, whereas 50% inhibition of relative growth rate occurred at 2.0, 2.4, and 13.3 mg L⁻¹, respectively. Elevated phosphate concentration markedly reduced the toxicity of all investigated REEs. Among the six physiological parameters evaluated, total chlorophyll content proved to be the most sensitive indicator of REE-induced stress. The removal efficiency of dissolved REEs reached 94–96%. However, only 30–55% of the initial REE load accumulated in plant tissues, while the remainder was attributed to precipitation. Bioconcentration factors were 460 for Ce, 774 for Nd, and 419 for Sm. Neodymium showed the highest accumulation (3579 mg kg⁻¹ dry biomass). These results demonstrate that *Lemna gibba* efficiently removes ionic REEs from contaminated water. Nevertheless, the considerable accumulation of REEs in plant tissues suggests a potential route for their transfer into aquatic food webs, highlighting the ecological risks associated with increasing environmental REE contamination.

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References

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