

## EFFECTS OF LEAD ACCUMULATION ON THE AZOLLA CAROLINIANA–ANABAENA ASSOCIATION

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**Abstract:** The effect of lead accumulation on photopigment production, mineral nutrition, and *Anabaena* vegetative cell size and heterocyst formation in *Azolla caroliniana* was investigated. Plants were exposed to 0, 1, 5, 10, and 20 mg L<sup>-1</sup> lead acetate for ten days. Lead accumulation increased when plants were treated with higher lead concentrations. Results revealed a statistically significant decline in total chlorophyll, chlorophyll *a*, chlorophyll *b*, and carotenoids in 5, 10, and 20 mg Pb L<sup>-1</sup> treatment groups as compared to plants with 0 or 1 mg Pb L<sup>-1</sup> treatments. No statistically significant change in anthocyanin production was observed. Calcium, magnesium, and zinc concentrations in plants decreased in increasing treatment groups, whereas sodium and potassium concentrations increased. Nitrogen and carbon were also found to decrease in plant tissue. *Anabaena* vegetative cells decreased in size and heterocyst frequency declined rapidly in a Pb dose-dependent manner. These results indicate that, while *A. caroliniana* removes lead from aqueous solution, the heavy metal causes physiological and biochemical changes by impairing photosynthesis, changing mineral nutrition, and impeding the growth and formation of heterocysts of the symbiotic cyanobacteria that live within leaf cavities of the fronds.

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