



## Response of duckweed to lead exposure: phytomining, bioindicators and bioremediation

A.K. Hegazy<sup>a,\*</sup>, M.H. Emam<sup>a</sup>, L. Lovett-Doust<sup>b</sup>, E. Azab<sup>c,d</sup>, A.A. El-Khatib<sup>e</sup>

<sup>a</sup>Department of Botany and Microbiology, Faculty of Science, Cairo University, Giza, Egypt, Tel. +202 35676651; emails: hegazy@sci.cu.edu.eg (A.K. Hegazy), mona\_ecology@yahoo.com (M.H. Emam)

<sup>b</sup>Department of Biology and Chemistry, Nipissing University, North Bay, ON, Canada, email: lld@nipissingu.ca

<sup>c</sup>Department of Botany, Faculty of Science, Zagazig University, Zagazig, Egypt

<sup>d</sup>Department of Biotechnology, Faculty of Science, Taif University, Taif, Saudi Arabia, email: ehabazab@yahoo.com

<sup>e</sup>Department of Botany, Faculty of Science, Sohag University, Sohag, Egypt, email: aaelkhatib@yahoo.com

Received 13 August 2016; Accepted 26 January 2017

---

### ABSTRACT

The ability of aquatic macrophytes to bioaccumulate toxic metals relative to the concentrations of these metals in wastewater has led to their use as phytoremediators. Lead (Pb) is among the most serious environmental contaminants. This study assesses the gibbous duckweed (*Lemna gibba* L.) as a bioaccumulator and bioindicator of Pb pollution. The plant recovery from a 12-d exposure period in terms of re-releases of Pb from its tissues, and recovery of pigmentation was monitored. Duckweed was exposed to Pb-contaminated water by adding PbCO<sub>3</sub> at concentrations from 10 to 100 mg/L. At 2-d intervals, bioaccumulation, contaminant removal efficiency, pigment content, and bleaching were assessed. The efficiency of Pb removal after 12 d reached nearly 50% at the lowest Pb treatment (10 mg/L), but decreased at higher levels of Pb up to 100 mg/L. The highest bioconcentration factors (BCF) were achieved at low Pb treatment of 10 mg/L, which increased from nearly 200 mg/L after 2 d, to 943 mg/L after 12 d of exposure. Recovery from bleaching was around 50% for all photosynthetic pigments in plants exposed to 10–40 mg/L concentrations of Pb. The response of duckweed to Pb treatment and recovery from stress suggest its possible use as biosensor or biomonitor of Pb pollution, considering that active uptake, rather than low concentration gradient, is driving the absorption of Pb from the water medium.

**Keywords:** *Lemna gibba*; Bioaccumulation; Removal efficiency; Photosynthetic pigments; Bleaching; Phytoremediation

---

\* Corresponding author.