

银叶树对重金属污染湿地环境的适应性和修复潜力

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摘 要:【目的】探究银叶树对重金属污染的生长适应性和修复潜力, 为湿地重金属污染植物修复提供参考依据。【方法】以银叶树 (*Heritiera littoralis*) 为研究对象, 在盆栽条件下模拟湿地环境, 以不添加重金属为对照 (CK), 探究 T1 (Pb:50 mg·L⁻¹、Cd:5 mg·L⁻¹、Cu:100 mg·L⁻¹)、T2 (Pb:100 mg·L⁻¹、Cd:10 mg·L⁻¹、Cu:200 mg·L⁻¹)、T3 (Pb:200 mg·L⁻¹、Cd:20 mg·L⁻¹、Cu:400 mg·L⁻¹) 三个复合污染水平 (处理) 对银叶树幼苗生长、养分吸收及 Pb、Cd、Cu 累积的影响, 分析银叶树对重金属污染湿地环境的修复潜力。【结果】与 CK 相比, T1 对银叶树根部生物量无显著影响, 而 T2、T3 显著抑制根部生物量生长, 三个处理银叶树株高、地上生物量、总生物量与 CK 无显著差异; T1 处理下银叶树耐性系数为 103.96%, T2、T3 处理下分别降至 95.18%、80.80%; 三个处理银叶树 N、P、K 吸收量未受显著影响。随着重金属浓度增加, 银叶树对 Pb、Cd、Cu 吸收累积均不断增加, 且大部分储存在根部; 三个处理银叶树对 Pb、Cu 的转运系数较对照均显著下降, 对 Cd 的转运系数则呈现先提高后下降的趋势。熵权 TOPSIS 模型评价结果显示, 银叶树在 T3 处理下其修复潜力最高, T2、T1 次之。【结论】银叶树对复合重金属污染湿地生长适应性较好, 但过高重金属浓度显著抑制根系生长, 在 Pb 含量≤50 mg·L⁻¹、Cd 含量≤5 mg·L⁻¹、Cu 含量≤100 mg·L⁻¹ 重金属污染湿地环境中, 银叶树生长不受影响, 具有一定污染修复潜力。

关键词: Pb、Cd、Cu; 银叶树; 植物修复; 湿地; 重金属污染

Adaptability and remediation potential of *Heritiera littoralis* to heavy metal pollution in wetlands

Abstract: 【Objective】The aim of this study was to investigate the growth adaptability and remediation potential of *Heritiera littoralis* to heavy metal pollution, and to provide a reference basis for phytoremediation in wetlands. 【Method】*H. littoralis* was studied in a simulated wetland environment under potted conditions, with no added heavy metals as control (CK), to investigate the effects of T₁ (adding Pb 50 mg·L⁻¹, Cd 5 mg·L⁻¹, Cu 100 mg·L⁻¹), T₂ (adding Pb 100 mg·L⁻¹, Cd 10 mg·L⁻¹, Cu 200 mg·L⁻¹) and T₃ (adding Pb 200 mg·L⁻¹, Cd 20 mg·L⁻¹, Cu 400 mg·L⁻¹) on the growth, nutrient uptake, and Pb, Cd, and Cu accumulation of *H. littoralis*, in order to analyze the remediation potential of *H. littoralis* for heavy metal polluted wetland environments. 【Results】The root biomass of *H. littoralis* was not different from T₁ compared with CK, but significantly inhibited under T₂ and T₃, besides, the plant height, aboveground biomass and total biomass of *H. littoralis* were not different from CK under all three treatments. The tolerance index was 103.96% under T₁, but decreased to 95.18% and 80.80% under T₂ and T₃, while the N, P and K uptake by *H. littoralis* was not affected under T₁, T₂ and T₃. With the increase of heavy metal concentration, the accumulation of Pb, Cd and Cu uptake by *H. littoralis* increased continuously, and most of them were stored in the roots. The transfer factor of Pb and Cu decreased significantly under three treatments compared with CK, while the transfer factor of Cd showed a trend of first increase and then decrease. The results of the entropy-weighted TOPSIS model showed that *H. littoralis* had the highest remediation potential under T₃, followed by T₂ and T₁. 【Conclusion】*H. littoralis* is well adapted to grow in heavy metal polluted wetlands, but excessive heavy metal concentrations significantly inhibit root growth. In Pb content ≤50 mg·L⁻¹, Cd content ≤5 mg·L⁻¹ and Cu content ≤100 mg·L⁻¹, the growth of *H. littoralis* was not affected, with a certain potential to remediate heavy metal pollution.

Keywords: Pb, Cd, Cu; *Heritiera littoralis*; Phytoremediation; Wetland; Heavy metal pollution