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TRIACONTANOL PROMOTES CADMIUM AND LEAD ENRICHMENT IN ACIDIC SOIL VIA *TAGETES PATULA* L.

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Abstract

Heavy metal complex pollution presents a significant threat to both soil quality and crop safety. Phytoremediation offers a sustainable approach to completely remove toxic heavy metals from soil without harming the soil environment; however, its application is limited by low remediation efficiency. To enhance the phytoremediation performance of *Tagetes patula* L. in acidic soils contaminated with cadmium (Cd) and lead (Pb), the plant growth regulator (PGR) triacontanol was applied via foliar spraying. This study aimed to enhance the plant's ability to accumulate Cd and Pb, while elucidating the mechanisms underlying this enhancement. Results indicated that optimal phytoremediation was achieved with triacontanol diluted at a ratio of 1:1000 during the flowering stage. Leaves were identified as the primary sites of metal accumulation. The application of triacontanol significantly increased biomass as well as Cd and Pb concentrations in *T. patula* leaves, with maximum increases of 11.63%, 27.61%, and 19.40%, respectively. Furthermore, a greater proportion of Cd and Pb was sequestered within the leaf cell walls. Moreover, foliar application of triacontanol led to a reduction in rhizosphere soil pH, which increased the available and exchangeable forms of Cd and Pb, thereby enhancing root absorption. The Cd and Pb concentration in the soil decreased further, with the highest reduction rates of 4.55% and 4.10%, respectively. These findings provide a theoretical foundation and technical support for employing triacontanol to enhance the phytoremediation efficiency of Cd- and Pb-contaminated soils.

Key words: acid soil, combined pollution, phytoremediation, plant growth regulator

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