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Study on the migration mechanism of vanadium and chromium in the water-soil interface during the growth of peas

YING CHEN, QIAN DENG, HUA TANG, ZHE HAN YANG AND YI HUANG

Chengdu University of Technology

Abstract

Vanadium (V) and chromium (Cr) are transition metals known for their environmental mobility and toxicity (Shahid et al. 2017; Aihemaiti et al. 2020). This study investigates their dynamics in a soil-pore water-plant system to enhance understanding of their biogeochemical behavior under coexistence conditions. Using comprehensive sampling and analysis, including soil, pore water, and plant analysis, we evaluated their distribution and transformation(Chen et al. 2021). The Risk Assessment Code for Heavy Metals categorizes exogenous V releases as negligible risk, whereas Cr releases pose a moderate risk .

Results show that Cr^{6+} exhibits higher mobility and release compared to V across various plant growth stages. Exogenous V additions increased water-soluble V in plants, while decreasing water-soluble Cr in that both metals predominantly reside in the cell wall fractions under natural conditions, shifting to soluble fractions with exogenous inputs. Structural equation modeling indicated significant positive correlations between soil acid-soluble V and Cr and water-soluble V and Cr in plants . These findings highlight the role of soil chemistry and external amendments in metal mobility and uptake.

In conclusion, this study provides critical insights into managing combined V and Cr pollution in soil environments, informing future ecological remediation efforts(Ahmad et al. 2021).

Keywords—**Vanadium and chromium coexistence; soil-pore water-plant system; heavy metal transport transformation; inter-root microorganism**

Reference

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