THE ACCUMULATION OF COMPOUNDS HEAVY METAL BY FUSSY MATHEMATIC EVALUATION AND THE ANTIOXIDANT ENZYMES ACTIVITIES IN FIVE SPECIES OF TERRESTRIAL PLANTS

Hai Lin[1,2], Ye Tian[1,2], Yingbo Dong[1,2)], Haili Zhang[1,2], Lulu Liu[1,2], Si Chen[1,2]

[1]Department of Environmental Engineering，University of Science and Technology Beijing，10083，China

[2]Beijing Key Laboratory on Resource-oriented Treatment of Industrial Pollutants，10083，China

linhai@ces.ustb.edu.cn

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Introduction

There are a number of mines containing heavy metal in water region and vanadium acquisition and processing industry developed. During the work of vanadium mine, the surface runoff carry heavy metal to soil and river. Various steps for reducing heavy metal from the mine sites have been under-taken by the environmental management (Vermaet al., 2012). Phytoremediation technology is one of the best and ecofriendly alternative management to prevent the heavy metal into soil and river. A greenhouse experiment was designed to investigate the effects of compounds heavy metal stress on the metal accumulation and activity of antioxidative enzymes of plants.

Methods

Plants used for the experiment were *Pteris vittata L.*，*Artemisia selengensis*，*Trifolium repens*，*Houttuynia cordata* and *Medicago sativ*. The 40g healthy seedlings each kind of plants were selected. 500mL compound heavy metals solution containing 1/5 diluted Hoagland nutrient solution were added to each pot. There were four treatments with the compound heavy metals (V、Cr、Cd) concentrations (1HM: 1.4, 0.6, 0.08mg·L^{-1}; 5HM: 7.0, 3.0, 0.4 mg·L^{-1}; 10HM: 14.0, 6.0, 0.8 mg·L^{-1}; 20HM: 28.0, 12.0, 1.6mg·L^{-1}). Three replicates were used for each treatment. The nutrient solution was aerated continuously and replaced every 7 days. The growth responses of plants were measured and the plants were harvested after 5 weeks. Concentrations of heavy metal in plants were determined by ICP-OES. SOD activity was determined by the method of NBT. CAT activity was measured according the method of Beer and Sizer. POD activity was determined by the method of Zhang.

Results

The shoot concentration of V in *Pteris vittata L.* was significantly higher than that of other plants at 5HM, 10HM and 20HM and reached 1908 mg kg^{-1} at 20HM(Fig. 1). The shoot concentration of Cr in *Pteris vittata L.* was significantly higher than that of other plants at 5HM, 10HM and 20HM and reached 2016 mg kg^{-1} at 20HM. The shoot concentration of Cd in *Houttuynia cordata* and *Trifolium repens* was significantly higher than that of other plants and reached a maximum (145 mg•kg^{-1} and 111 mg•kg^{-1}) at 10HM, respectively.

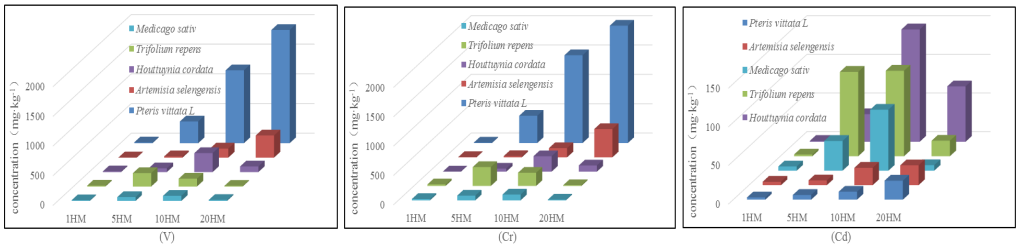

Figure 1. The concentration of heavy metal in shoot

The heavy metal concentration in solution and the plants was input, and heavy metal accumulation in plants was output. The input and output were added to MATLAB fuzzy function. The changes in enzymes (SOD, POD, CAT) activities demonstrated the plants' tolerance to heavy metal stress, which varied by species.

Conclusion

The present study showed that the *Pteris vittata L.* showed great uptake capacity to V and Cr at compounds heavy metal (V, Cr, Cd) condition and the cooperative work of the antioxidative enzymes contributed to the tolerance of the *Pteris vittata L.*to the compounds heavy metal stress. The uptake capacity to Cd of the *Trifolium repens* was stronger than other plants at compounds heavy metal condition. The *Pteris vittata L.* can further be suggested for its suitability for V and Cr phytoremediation purposes at compounds heavy metal condition and the *Trifolium repens* can further be suggested for Cd phytoremediation purposes.

References

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