

Root exudates of *Arabidopsis halleri* ssp. *gemmifera* enhance Cd and Zn extraction in a contaminated soil

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Arabidopsis halleri ssp. *gemmifera* is a Cd and Zn hyper-accumulator. In our previous study vegetating this plant on a Cd-contaminating soil, total Cd concentration in the soil was significantly decreased. Our data also showed that bioavailable fraction of Cd in the soil stayed constant during experimental period, although the fraction should be absorbed by the plant and decreased its value in the soil. These results suggest that root exudates of the plant might contribute an extraction of Cd in the soil to exude some compounds to rhizosphere. To confirm of this hypothesis, leaching experiment of the soil using 0.1mM CaCl₂ solution containing the root exudates was conducted.

A.halleri ssp. *gemmifera* was germinated in dark and cultivated in an hydroponic condition using 1/5 Hoagland nutrients solution for 4 months. After the hydroponic cultivation, the plants were transferred to normal condition (+Fe) and Fe deficiency condition (-Fe) for 7 days. Then, plants were transferred another bottles containing 200 mL of 0.1 mM CaCl₂ solution with light for 3 hours according to Zhao *et al.* [1]. The resulting CaCl₂ solution containing root exudates was concentrated up to 30 mL by rotary evaporator at 80°C in vacuum. Leaching experiment of the Cd contaminated soil were used CaCl₂ solution (control) and CaCl₂ containing +Fe root exudates or -Fe root exudates. As a results, concentration of Cd, Zn and Fe from the soil extracted by CaCl₂ solution containing +Fe root exudates was higher than that of control and -Fe treatment. On -Fe treatment, Cd and Zn concentration were the same as control, though Fe concentration was higher than control.

Whole root was placed on a 3 mm thick agar-gel containing bromocresol purple as pH indicator (pH range: 5.2-6.8) for 6 hours [2] to show pH change of the root exudates. In case of +Fe treatment, pH value indicated acidic for the first two hours, but the value showed neutral after 2 hours. In contrast, pH values were always neutral in case of -Fe treatment. These results may indicate that *A. halleri* ssp. *gemmifera* release several kinds of root exudates and some of them enhance to dissolve Cd and Zn in soil.

[1] Zhao *et al.* (2001) *New Phytologist* 151: 613-620.

[2] Zhao *et al.* (2009) *Science of The Total Environment* 407: 4356-4362.