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# Influence of pH on soil washing and phytoextraction of Cd from soil, a case study using the paddy-field soil with a high pH

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Applications of alkaline materials and continuous flooding are practical methods to suppress uptake and accumulation of Cd into rice grains in moderately low cadmium contaminated paddy fields. However, flooding is not applicable to upland fields. When alkaline materials are not enough to suppress Cd uptake, additional managements are needed. Among various remediation methods, soil washing (Hayashi 2007) and phytoextraction are promising methods to reduce Cd uptake.

The objectives of this study were to evaluate the influence of pH on soil washing and phytoextraction using Cyoukoukoku when these restorations are conducted in the paddy-field soil with a high pH.

As chemicals for soil washing, FeCl<sub>3</sub> was used. The paddy-field soil was previously limed to reduce Cd uptake by rice plants. A 40 kg portion of field-moist soil was placed into a 75 L plastic container with 30 L tap water and 540 g FeCl<sub>3</sub> · 6H<sub>2</sub>O, the soil suspension was thoroughly stirred for 1 h and the mixture was allowed to stand for 1 day. After sedimentation of soil, the supernatant solution was removed. The soil was rinsed repeatedly with tap water to eliminate excessive salts. After FeCl<sub>3</sub> washing, the content of Cd extractable in 0.1 mol L<sup>-1</sup> HCl decreased from 5.6 to 3.0 mg kg<sup>-1</sup>, soil pH changed from 7.7 to 5.3. Subsequently, we conducted a pot experiment to evaluate the effect of soil washing with FeCl<sub>3</sub> on Cd adsorption by soybean. We designed four kinds of treatments using washed and unwashed soil. Cd concentration of soybeans which were grown in washed soil was more than 1 mg kg<sup>-1</sup> and evident reduction by soil washing was not found. High pH of the used soil may be a major reason for the results. Cadmium in soil was transformed between exchangeable and inorganic fractions with pH change. Because FeCl<sub>3</sub> extracted mainly the acid-soluble form of Cd, exchangeable fraction increased with decreasing soil pH caused by the washing treatment.

Phytoextraction using Cyoukoukoku, a rice variety, was conducted to evaluate the reduction of soil Cd. We carried out rice cultivation experiments twice for a year using washed and unwashed soil in 5 L plastic pots. Water treatment used for the present study was a mimic midseason drainage with intermittent irrigation. After 2 cropings, the content of Cd extractable in 0.1 mol L<sup>-1</sup> HCl was approximately 10% lower than those before the rice cultivation. Cadmium uptake in the shoot was affected by the water treatment and soil pH.

Judging from the results of this study, we confirmed the Cd extraction with FeCl<sub>3</sub> was more effective than the present phytoextraction using Cyoukoukoku although cultivation was only twice, but it is necessary to pay attention to chemical forms of Cd affected by pH.

## References

Hayashi, T., T. Kida, M. Nanzyo, T. Takahashi, M. Honna, Y. Aikawa and K. Yoshihara (2007) Persistence of CaCl<sub>2</sub> washing effect for amelioration of a Cd-contaminated paddy field soil. *Soil Science and Plant Nutrition*, 53: 720-728.