

DEMETHYLATION OF METHYLMERCURY IN GROWING RICE: AN EVIDENCE OF RICE SELF-DETOXIFICATION FOR Hg POLLUTION?

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Introduction

Mercury (Hg) is one of the most used and toxic heavy metals in the environment. As reported from MEP (Ministry of Environmental Protection) and MLR (Ministry of Land and Resources), about 19.4% croplands were polluted by heavy metals (exceed National Standard). Hg in rice grains which account for about 16% of the total rice also exceeded the National Standard. Rice consumption is one of the most important paths of methylmercury (MeHg) exposure for Chinese people, which poses a potential health threat to the residents. Hence, it is of vital importance for us to investigate the sources of MeHg accumulated in rice. Conducting research to make clear the possibility of mercury methylation and demethylation processes in rice is a worthwhile challenge.

Methods

In the present study, a series of rice seedlings were exposed to inorganic mercury (IHg) or MeHg containing solutions for 20 days of pretreatment. The variation in contents of IHg and MeHg in rice roots and shoots collected every five days interval were analyzed with HPLC-ICP-MS and SR-XANES to reveal Hg species and the relative contents (Figure 1).

Results and Conclusions

The Hg content, distribution and speciation in rice plants were analyzed. The results displayed that MeHg contents in MeHg exposed rice roots and leaves decreased gradually (> 20%) while no prominent decrease of IHg in IHg exposed rice root and leaves was observed. All the results indicated that there was significant MeHg demethylation in rice plant while no remarkable IHg methylation with rice growth. SR-XANES analysis further confirmed the demethylation of MeHg in growing rice plant. The XANES results showed that MeHg in rice plant was mainly present in MeHgCys form. MeHgCys and Hg(GSH)₂ mercury forms in MeHg exposed rice accounted for above 80% of the total Hg in rice roots. The contents of MeHgCl and MeHgCys forms decreased from 12.5% to 3.6% and 51.3% to 36.2% respectively while Hg(GSH)₂ form increased from 32.3% to 56.9% of the total Hg in MeHg exposed rice roots within 20 days of rice growing. The discovery of MeHg demethylation in rice in this study may be quite beneficial to understand the Hg tolerance mechanism of rice plant and to further researches for seeking efficient approaches to reduce MeHg accumulation in rice grains. Based on the results, we try to seek efficient approaches to reduce the accumulation of total Hg especially MeHg in rice grain.

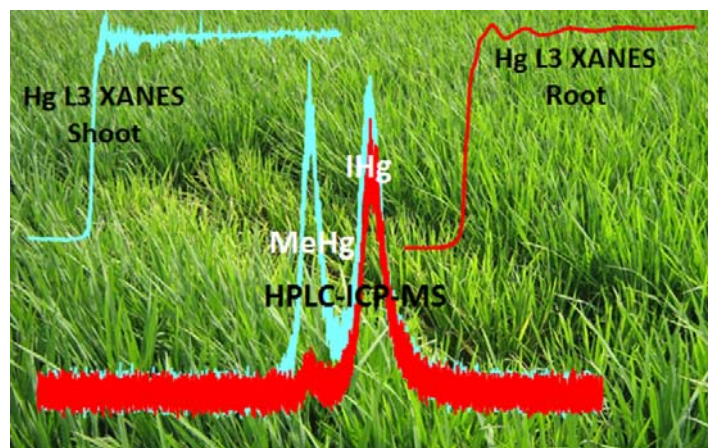


Figure 1 Demethylation of methylmercury in rice (*Oryza sativa* L.) detected using HPLC-ICP-MS combined with SR-XANES techniques: an evidence of rice plant against methylmercury phytotoxicity.