

## **Effects of low molecular weight organic acids on the Cu accumulation by castor bean and the soil enzyme activities**

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In recent years, the low molecular weight synthetic organic chelating agents have been used as inducers for phytoremediation in soil because of their relatively strong complexing ability with heavy metals. However, there were few reports on whether exogenous the low molecular weight organic acids (LMWOAs) could promote the uptake and transportation of Cu in castor bean. Previous studies have emphasized on the regulation of plant physiology or the metal accumulation under heavy-metal stress via the exogenous application of chelating agents such as LMWOAs, while ignoring their effect on soil properties such as enzymatic activities. This study was conducted to investigate the effects of LMWOAs applied in the soil on the phytoremediation efficiency by castor bean and soil enzyme activities were explored by a pot experiment. Results indicated that the addition of LMWOAs did not decrease the biomass of castor bean even through it reduced the concentration of chlorophyll a in leaves. The Cu concentrations in the roots and shoots significantly increased by 6-106% and 5-148%, respectively in the LMWOAs treatments so that the total accumulation of Cu by whole plants in all the LMWOAs treatments increased by 21-189% compared to control. The values of TF and BCF of Cu in castor bean also rose after addition of LMWOAs. Moreover, the application of did not significantly change the pH of the soil but significantly increased the activity of soil enzymes (urease, catalase and alkaline phosphatase). To sum up, the addition of exogenous LMWOAs promoted the phytoextraction efficiency of Cu by castor bean but it had no much the negative effects on soil.

Keywords: Cu; LMWOAs; Phytoextraction; castor bean; soil enzymes activities