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胶质芽孢杆菌对印度芥菜富集土壤Cd及土壤pH的影响

Effects of *Bacillus mucilaginosus* on soil pH and Cd accumulation by *Brassica juncea*

关键词：胶质芽孢杆菌 印度芥菜 有效态Cd pH值

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作 者 单位

杨 榕 河北农业大学 资源与环境科学学院, 保定 071001

李博文 1. 河北农业大学 资源与环境科学学院, 保定 071001;

2. 河北省农田生态环境重点实验室, 保定 071001

刘 微 河北大学化学与环境科学学院, 保定 071002

摘要：采用根袋法盆栽试验,研究接种活菌量浓度分别为1×10^{10} cfu·kg^{-1}(T1)和2×10^{10} cfu·kg^{-1}(T2)的胶质芽孢杆菌,对印度芥菜富集土壤Cd、土壤有效态Cd含量及土壤pH的影响.结果表明,以不接种菌液作为对照,处理T1、T2地上部分生物富集系数分别为13.58、16.83,与对照相比分别提高42.95%、77.16%;地下部分生物富集系数分别为4.35、4.83,分别比对照提高24.64%、38.40%;土壤的净化率分别是对照的1.73、2.20倍.对照组土壤有效态Cd含量随着时间的延长而降低,根际和非根际土壤分别降低32.93%和45.54%;但T1和T2处理中,根际、非根际土壤有效态Cd含量分别提高15.15%、31.73%和36.54%、45.28%.收获时,处理T1、T2根际土壤pH降低率分别是对照的1.08、1.10倍.不同浓度胶质芽孢杆菌处理下土壤pH与有效态Cd含量均呈显著负线性关系.综上,胶质芽孢杆菌主要是通过改变土壤pH来影响土壤Cd生物有效性,从而促进超富集植物的修复效果.本研究可为微生物辅助植物修复重金属污染土壤提供一定理论依据和实践指导.

Abstract: The effects of two inoculum concentrations of *Bacillus mucilaginosus* (1×10^{10} cfu·kg^{-1}(T1) and 2×10^{10} cfu·kg^{-1}(T2)) on Cd accumulation in *Brassica juncea*, available Cd concentration and pH in soil were investigated using root bag pot culture experiments. The results showed that the Cd bioconcentration factor of aboveground parts in treatment T1 and T2 were 13.58 and 16.83, respectively. Compared with the control without addition of *Bacillus mucilaginosus*, there were 42.95% and 77.16% increases, respectively. Likewise, the Cd bioconcentration factor of underground parts of T1 and T2 were 4.35 and 4.83, corresponding to 24.64% and 38.40% increases compared with the control, respectively. Meanwhile, the removal rate of T1 and T2 were 1.73 and 2.20 times that of the control. The concentrations of soil available Cd in control showed a decrease pattern with time, and the decrease rates of rhizosphere and non-rhizosphere concentrations of available Cd were 32.93% and 45.54%, respectively. However, there were 15.15%, 31.73% and 36.54%, 45.28% increases in rhizosphere and non-rhizosphere concentrations of available Cd in treatment T1 and T2, respectively. At harvest, the decrease rates of rhizosphere pH in T1 and T2 were 1.08 and 1.10 times than that of the control. Under different inoculum concentrations of *Bacillus mucilaginosus,* negative correlations were observed between concentrations of available Cd and pH in soil. In summary, the results indicated that *Bacillus mucilaginosus* could enhance the remediation effect of hyperaccumulator by impacting the availability of Cd through reducing pH in soil. Therefore, this study could provide theoretical and experimental guidance for microbial phytoremediation of heavy mental contaminated soils.

Key words: *Bacillus mucilaginosus* *Brassica juncea* available Cd pH

主办单位：中国科学院生态环境研究中心

单位地址：北京市海淀区双清路18号 邮编：100085

服务热线：010-62941073 传真：010-62941073 Email：hjkxxb@rcees.ac.cn