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鼠李糖脂对林丹-重金属复合污染土壤的同步淋洗效果研究

Simultaneous removal of lindane and heavy metals from contaminated soils by rhamnolipids enhanced washing

关键词: [有机氯农药](#) [重金属](#) [土壤污染](#) [淋洗](#) [鼠李糖脂](#)

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摘要: 选取典型有机氯农药林丹及典型重金属Pb、Cd为目标污染物,以模拟污染土壤为对象,考察了鼠李糖脂对林丹/重金属的增溶/配合作用及其影响因素,同时分析了淋洗前后土壤重金属的形态变化,并深入研究了鼠李糖脂对林丹-重金属复合污染土壤的淋洗效果.结果表明,林丹溶解度随鼠李糖脂浓度及离子强度的提高显著增大,但随着pH(5.0~10.0)的提高而逐渐降低.鼠李糖脂对Pb的配合能力大于Cd,两种重金属的配合浓度随鼠李糖脂浓度的增加而增加;pH提高对Pb的配合有抑制作用,而对Cd有所促进.鼠李糖脂在土壤上的吸附符合线性等温吸附.当鼠李糖脂浓度高于5000 mg·L⁻¹时,其对3种污染物的淋洗开始有显著效果;当鼠李糖脂浓度为40000 mg·L⁻¹时,其对林丹、Pb及Cd的去除率分别达到76.9%、18.0%和100%,且pH为7.0时淋洗效果最好.同时,鼠李糖脂对不同形态Pb和Cd的去除能力有差异,其中,对可交换态重金属的去除最为有效.

Abstract: In this study, the effect of rhamnolipids on the simultaneous removal of one representative organochlorine pesticide (OCPs), lindane, and two heavy metals, Pb and Cd, from simulated soils was investigated. Capacity and influencing factors of rhamnolipids to solubilize lindane and complex Pb and Cd in aqueous solutions were explored. Furthermore, speciation analysis of heavy metals in soils before and after washing was conducted. Results showed that lindane solubility increased with elevated ionic strength, while decreased as pH rose from 5.0 to 10.0. The complexation of Pb with rhamnolipids was stronger than that of Cd. The higher the rhamnolipids concentration was, the larger the complexed concentration of Pb and Cd. However, as pH rose from 5.5 to 10.0, the complexation of Pb and Cd with rhamnolipids was inhibited and promoted, respectively. The sorption of rhamnolipids to soil can be fitted using a linear isotherm. In addition, significant removal of lindane and heavy metals from soils was achieved when rhamnolipids concentration was above 5000 mg·L⁻¹. Particularly, the desorption rate was 76.9%, 18.0% and 100% for lindane, Pb and Cd, respectively, at rhamnolipids concentration of 40000 mg·L⁻¹, and the optimal pH value was 7.0. It was also suggested that the removal efficiency of Pb and Cd by rhamnolipids was strongly related to their speciation in soils, and metals in exchangeable stage could be removed more effectively.

Key words: [organochlorine pesticides \(OCPs\)](#) [heavy metals](#) [soil contamination](#) [soil washing](#) [rhamnolipids](#)

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