


王展,张玉龙,张砚铭,王丽娟,郑明明:冻融对土壤吸附态镉赋存形态及生物活性的影响[J].环境科学学报,2013,33(3):821-826

冻融对土壤吸附态镉赋存形态及生物活性的影响 

The effect of freezing-thawing cycle on the combined forms and availability of the adsorbed Cd²⁺ in soil

关键词: [冻融](#) [土壤](#) [镉](#) [吸附](#) [形态](#) [生物活性](#)

基金项目: [国家重点基础研究发展\(973\)计划\(No.2004CB418504\)](#)

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摘要: 以东北地区棕壤为供试土壤,通过人工控温、室内培养的方法,测定了不同冻融次数(冻融温度-30~20 °C,冻融时间24 h,冻融次数0、1、3、6、9次)和不同土壤含水量处理下(田间持水量的10%、40%、70%、100%、120%),外源镉浓度为20 mg · L⁻¹时,土壤吸附态镉的不同赋存形态的含量,并分析了各赋存形态镉占吸附态镉总量的比率及吸附态镉生物活性的变化.结果表明,不同冻融处理土壤吸附的重金属镉中,各赋存形态镉占吸附态镉的比率顺序为:交换态>残渣态>碳酸盐结合态>铁锰氧化物结合态>有机结合态.各赋存形态镉占吸附态镉的比率随冻融次数和土壤含水量的变化呈不同趋势.冻融次数对交换态镉、碳酸盐结合态镉、铁锰氧化物结合态镉、残渣态镉的影响均达到显著或极显著水平,对有机结合态镉的影响不显著;含水量对交换态镉、碳酸盐结合态镉、铁锰氧化物结合态镉的影响达到显著或极显著水平,对有机结合态镉和残渣态镉的影响不显著.供试土壤中吸附态镉的生物活性较强,生物可利用系数和移动系数分别达到65.9638%和62.9851%.生物可利用性系数和迁移系数均随着冻融次数的增加先增加后降低,然后趋于平稳,说明土壤自身在一定范围内存在着缓冲能力.

Abstract: The effect of the freezing and thawing frequency and soil water content on the combined forms and availability of adsorbed Cd of brown soil collected from the Northeast China was investigated. 20 mg · L⁻¹ Cd was added to the soil and the soil was incubated at -30 °C and 20 °C for 24 h, respectively. Soil samples of different water content (10%, 40%, 70%, 100% and 120% of the field capacity) were subsequently refrozen and thawed for 0, 1, 3, 6, 9 cycles. The different combined forms of Cd²⁺ were determined with sequential extraction method. The result showed that the order of the ratio of different combined forms of Cd to the adsorbed Cd²⁺ was exchangeable form > residual form > bound to carbonates form > bound to Fe-Mn oxides form > bound to organic matter form. The ratios of different combined forms of Cd to the adsorbed Cd²⁺ varied along with the change of freezing-thawing cycle frequency and soil water content. The effect of the freezing and thawing times on exchangeable Cd, bound to carbonates Cd, bound to Fe-Mn oxides Cd and residual Cd was significant, while the effect on bound to organic matter Cd was insignificant. The effect of soil water content on exchangeable Cd, bound to carbonates Cd, bound to Fe-Mn oxides Cd was significant, while the effect on bound to organic matter Cd and residual Cd was insignificant. The adsorbed Cd in the sampled soil possessed very strong availability, and the availability index (*K*) and mobility index (*M*) were 65.9638% and 62.9851%, respectively. The *K* and *M* increased firstly, then decreased and finally reached a plateau with the increasing freezing and thawing frequency, which indicated that the soil had buffer capacity in some extent.

Key words: [freezing and thawing](#) [soil](#) [Cd adsorption](#) [combined forms](#) [availability](#)

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