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农耕地土壤¹³⁷Cs与²¹⁰Pb_{ex}深度分布过程对比研究张云奇^{1,2}, 张信宝³, 龙翼³, 贺秀斌³, 于兴修²

1. 四川农业大学, 四川 都江堰 611830;
2. 临沂大学资源环境学院/山东省水土保持与环境保育重点实验室, 山东 临沂 276000;
3. 中国科学院水利部成都山地灾害与环境研究所, 四川 成都 610041

摘要: 探讨了¹³⁷Cs与²¹⁰Pb_{ex}在农耕地土壤深度分布过程的差异。基于¹³⁷Cs与²¹⁰Pb_{ex}的不同沉降过程, 考虑到核素由犁耕层向犁底层的扩散, 对农耕地土壤¹³⁷Cs、²¹⁰Pb_{ex}的深度分布过程进行了理论推导, 并以杨凌符家庄麦田剖面的实测数据予以验证, 同时讨论了实测符家庄麦田剖面¹³⁷Cs、²¹⁰Pb_{ex}深度分布的规律特征及其原因, 以此阐明了¹³⁷Cs与²¹⁰Pb_{ex}在农耕地土壤深度分布过程的差异。¹³⁷Cs源于大气核试爆, 没有持续沉降补充, 犁耕层和犁底层土壤¹³⁷Cs深度分布一直处于随时间变化的非稳定态; 而²¹⁰Pb_{ex}是天然核素, 存在大气沉降的持续补充, 犁耕层和犁底层土壤²¹⁰Pb_{ex}深度分布最终呈稳定态。农耕地土壤¹³⁷Cs、²¹⁰Pb_{ex}深度分布的实测值曲线与理论值曲线的差异, 尤其²¹⁰Pb_{ex}可能与耕作深度的变化历史或土地利用(覆被)变化有关。

关键词: 农耕地土壤 ¹³⁷Cs ²¹⁰Pb_{ex} 深度分布过程

COMPARISON OF THE DEPTH DISTRIBUTION PROCESSES FOR ¹³⁷Cs AND ²¹⁰Pb_{ex} IN CULTIVATED SOILSZHANG Yun-qi^{1,2}, ZHANG Xin-bao³, LONG Yi³, HE Xiu-bin³, YU Xing-xiu²

1. Sichuan Agriculture University, Dujiangyan, Sichuan 611830;
2. Shandong Provincial Key Laboratory of Water and Soil Conservation & Environment Protection, College of Resource and Environmental Science, Linyi University, Linyi, Shandong 276000;
3. Institute of Mountain Hazards and Environment, CAS, Chengdu, Sichuan 610041

Abstract: This paper focuses on the different processes of ¹³⁷Cs and ²¹⁰Pb_{ex} depth distribution in cultivated soils. In view of their different fallout deposition processes, considering radionuclide will diffuse from the plough layer to the plough pan layer due to the concentration gradient between the two layers, the ¹³⁷Cs and ²¹⁰Pb_{ex} depth distribution processes were theoretically derived. Additionally, the theoretical derivation was verified by the measured ¹³⁷Cs and ²¹⁰Pb_{ex} values in the soil core collected from wheat field in Fujiazhuang, Shanxi Province, China, and the ¹³⁷Cs and ²¹⁰Pb_{ex} concentrations variation with depth in soils of the wheat field was explained rationally. The ¹³⁷Cs depth distribution state in cultivated soils will consistently vary with time due to ¹³⁷Cs continual decay and diffusion as an artificial radionuclide without sustainable fallout input since 1960s. In contrast, the ²¹⁰Pb_{ex} depth distribution in cultivated soils will achieve steady state because of sustainable deposition of the naturally occurring ²¹⁰Pb_{ex} fallout, and it can be concluded that the differences between the theoretical and the measured values, especially for ²¹⁰Pb_{ex}, might be associated with the history of plough depth variation or LUCC.

Keywords: cultivated soil ¹³⁷Cs ²¹⁰Pb_{ex} depth distribution process

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通讯作者: 于兴修(1967-), 男, 山东莒县人, 博士, 教授, 主要从事水土保持研究。Tel: 0539-8766307; E-mail: xxy2000@126.com

作者简介:

作者Email: xxy2000@126.com

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