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废弃生产场地有机氯农药的残留与迁移特征

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Distribution and Diffusion of Organochlorine Pesticides in Soils from an Abandoned Manufacturing Site

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中文摘要:

我国历史上曾生产和使用了大量的有机氯农药, 现存的有机氯农药生产企业场地是污染高风险区。先前的报道多集中在场地内污染特征研究, 较少关注场地周边有机氯农药污染及其环境风险性。为了解有机氯农药场地土壤污染水平及其对周边环境的影响, 本文以重庆某废弃有机氯农药场地及其周边为研究区域, 分析土壤中六六六(HCHs)、滴滴涕(DDTs)及其降解产物的含量水平, 阐明场地内污染特征以及周边土壤的残留规律, 评估场地内及周边土壤中有机氯农药污染的人体健康风险。结果表明, 场地土壤中 Σ HCHs的含量水平为 $3.89 \sim 13385.78 \text{ ng/g}$, 低于国内已报道的其他污染场地。 Σ DDTs的含量水平为 $22.74 \sim 11186.10 \text{ ng/g}$, 与已报道的我国张家口、扬州等地生产场地污染水平相当, 但低于邢台、太原和青岛等地农药厂生产场地污染水平。该生产场地土壤中有机氯农药污染的人体致癌风险值均高于可接受的范围, 属于重污染区。场地周边400 m范围的土壤中HCHs和DDTs的含量水平虽整体上低于场地内, 但污染水平也较高, HCHs污染和DDTs污染的总致癌风险均超过了儿童可接受的限值。随着与生产场地距离的增加, 场地周边土壤HCHs和DDTs的含量水平呈幂函数下降的趋势, 这同时又表明生产场地有机氯农药仅对场地周边一定范围内的环境产生较大污染。因此, 对于生产场地污染不能仅仅关注场地内, 还应充分考虑场地周边一定范围内的污染与环境风险性。

In past decades, large amounts of organochlorine pesticides (OCPs) were produced and used in China. These abandoned OCPs manufacturer sites have become high-risk areas. Previous studies have investigated the contamination status of OCPs in these sites. However, most of the available data focused only on the inside of the factory and few studies consider the pollutions and risks of OCPs in the surrounding area. Levels and distributions of hexachlorocyclohexanes (HCHs), dichlorodiphenyltrichloroethanes (DDTs) and DDT metabolites were investigated in surface soils from an abandoned manufacturing site, in Chongqing, southwest China, in order to better understand the contamination status and environmental impact on the surrounding area. In this study, the potential human health risks were also assessed from within the factory and from the surrounding area. Concentrations of Σ HCHs ranged from 3.89 to 13385.78 ng/g in surface soils from inside the factory, which were generally lower than those reported in other contaminated sites. Levels of Σ DDTs ranged from 22.74 ng/g to 11186.10 ng/g in surface soils, which were consistent with previous observations in contaminated sites located in Zhangjiakou and Yangzhou city, but lower than those in Xingtai, Taiyuan and Qingdao city. The results of health risk assessment showed that the carcinogenic risk of OCP contaminants exceeded the acceptable risk in soils from inside the factory, which contributed to the heavily-polluted area. Within 400 meters from the manufacturing facility, the levels of OCPs in soils were also high although they were lower than those inside the factory. To children, the carcinogenic risk of HCHs and DDTs in surface soils is still higher than the standard recommended by some research institutions. With the distance increasing to the site, levels of HCHs and DDTs decreased with the trend of the power function, which indicated that the pollution of OCPs only occurred in a certain region outside the factory. Therefore, the OCP pollutions and risks should be considered from not only inside contaminated sites but also certain regions outside sites.

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