

## 合作发表文章

### 中国某电子垃圾处理场土壤中多类化学污染物的发生与空间分布

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关联机种：GCMS-TQ8050，使用岛津GCMS-TQ8050测定电子废弃物处置站周边土壤中的多溴二苯醚（PBDEs）和溴代二噁英（PBDD/Fs）。

#### Multiple classes of chemical contaminants in soil from an e-waste disposal site in China: Occurrence and spatial distribution

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#### 【ABSTRACT】

E-waste recycling is well known for releasing halogenated organic compounds (HOCs) and heavy metals. This study investigated the occurrence and distribution of traditional and novel classes of contaminants, including chlorinated, brominated, and mixed halogenated dibenzo-p-dioxins/dibenzofurans (PCDD/Fs, PBDD/Fs, PXDD/Fs), polybrominated diphenyl ethers (PBDEs), polychlorinated biphenyls (PCBs) and polyhalogenated carbazoles (PHCZs), in soil from an e-waste disposal site in Hangzhou. PBDEs were the most abundant, at 343–69306 ng kg<sup>-1</sup>, followed by PHCZs (896–41,362 ng kg<sup>-1</sup>), PCDD/Fs (349–19,396 ng kg<sup>-1</sup>), PCBs (51.3–1834 ng kg<sup>-1</sup>), PBDD/Fs (2.99–524 ng kg<sup>-1</sup>) and PXDD/Fs (0.104–21.2 ng kg<sup>-1</sup>). The detected target compound concentrations were generally lower than those reported in the literature for informal e-waste sites. Nevertheless, they can serve as a basis of information for evaluation and subsequent control. The toxic equivalent (TEQ) contributions from these contaminants (except PBDEs) decreased as follows: PCDD/Fs > PXDD/Fs > PHCZs > PCBs > PBDD/Fs. ΣDioxins (PCDD/Fs + PBDD/Fs + PXDD/Fs) accounted for 47.7%–97.2% of the total TEQs in the soil. OCDD, 1,2,3,4,6,7,8-HpBDF and OBDF were the dominant congeners, mainly derived from combustion and transport because of their low saturated vapor pressure. PXDFs were more abundant than PXDDs, and homologue profiles suggested a similar formation mechanism for PXDFs and PBDFs involving successive Br-to-Cl exchange. PHCZs were reported in soil from an e-waste disposal area for the first time, and their concentrations were several orders of magnitude higher than those of the other contaminants. Although the risk of human exposure in this study was estimated to be lower than the values recommended by the WHO (1–4 pg TEQ/kg bw/day), health implications still exist, and further investigations are necessary.

#### 【文章概述】

本研究以杭州某电子废弃物处置站为中心，对周围的土壤布点采样，分析了多种环境持久性有机污染物的含量（包括了二噁英（PCDD/Fs）、多氯联苯（PCBs）、多溴二苯醚（PBDEs）、溴代二噁英（PBDD/Fs）、卤代二噁英（PXDD/Fs）和多卤代咔唑（PHCZs）），并且探究污染物浓度与距离电子废弃物处置点远近的关系。结果显示：浓度排序为 PBDEs > PHCZs > PCDD/Fs > PCBs > PBDD/Fs > PXDD/Fs；转化为毒性当量后排序为：PCDD/Fs > PXDD/Fs > PHCZs > PCBs > PBDD/Fs（PBDEs无毒性当量因子，不参与排序）。总体来看，污染物浓度随距电子废弃物处置中心点距离呈现下降的趋势，但其他人为因素（如汽车尾气排放、秸秆焚烧）也是此类污染物的重要来源之一。