

利用化学分析和生物毒性监测方法综合评价污水污泥环境影响的研究

李娟英, 苏磊, 陈洁芸, 李振华, 何培民

上海海洋大学农业部淡水水产种质资源重点实验室

Comprehensive Evaluation of Environmental Impact of Sewage Sludge Using Chemical Analysis and Bioassay

LI Juan-Ying, SU Lei, CHEN Jie-Yun, LI Zhen-Hua, HE Pei-Min

Key Laboratory of Freshwater Fishery Germplasm Resources, Ministry of Agriculture, Shanghai Ocean University

摘要

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摘要 利用化学分析和发光细菌生物毒性联合检测方法评价了上海地区7处污水处理厂污水污泥(分别用S1~S7表示)中主要污染物水平和毒性大小。结果表明, 污水污泥样品S5和S7的重金属超过CJ/T 309—2009《城镇污水处理厂污泥处置 农用泥质》标准和全国平均水平, 主要超标重金属为Cd、Hg和Cu; 污水污泥中多氯联苯、有机氯农药和二(口恶)英类含量与组成则处于安全水平; 样点S1~S6的多环芳烃(PAHs)平均含量低于CJ/T309-2009中A级标准与欧盟和美国关于污水污泥的土地倾倒标准, 但样点S7的 $w(\Sigma\text{PAHs})$ 达到 $34.61 \text{ mg}\cdot\text{kg}^{-1}$, 超过CJ/T309-2009最高允许限值的6倍。污水污泥浸出液化学分析结果表明, PAHs和重金属含量低于GB5085.3—2007《危险废物鉴别标准 浸出毒性鉴别》和欧盟EN 12457.2—2002《废弃物表征 浸出 颗粒废弃物和污泥浸出一致性试验》标准, 但所有样点的溶解性总有机碳均超过欧盟EN 12457.2—2002标准。发光细菌综合生物毒性结果表明: 样点S3的综合毒性最高, S1、S6和S7次之, S2、S4和S5较低, 以生活污水为主要来源的污水污泥的综合生物毒性较高。该结果可为污水污泥的后续处理和处置提供基础数据。

关键词: 化学分析 发光细菌毒性检测 重金属 污水污泥 浸出液

Abstract: Sewage sludge that contains heavy metals and organic pollutants that are often toxic and persistent even after its being released into the environment. Samples of sewage sludge were collected from seven wastewater treatment plants in Shanghai for chemical analysis in combination with microtox assay of the major pollutants in the samples. Results show that Samples S5 and S7 were high in heavy metal content (Cd, Hg and Cu), and higher than the average of the country and the criteria set in the Standard " CJ/T309-2009" for Agricultural Use of Sewage Sludge From Wastewater Treatment Plants, however, in terms of contents and compositions of PCBs, OCPs and PCDD/Fs, all the samples were found to be at the safe level; , and in terms of mean PAHs concentration, were lower than Class A Criteria of the Standard for sludge to be used in agriculture in China and the standard for sludge in land-filling in US and EU, as well, except for Sample S7. Which reached up to $34.61 \text{ mg}\cdot\text{kg}^{-1}$, being five to six times higher than the standards in China and EU. Chemical analysis of the leachates from the seven sludge samples shows that all the samples were lower in PAHs concentration than the standards for identification of hazardous waste, but higher in DOC content than the European standard. Microtox assay indicates that in integrated toxicity, Sample S3 was the highest and followed by S1, S6 and S7, and then by S2, S4 and S5, suggesting that sludge derived from domestic sewage is much higher in integrated toxicity. The findings may be cited as basic data for subsequent treatment and disposal of sewage sludge.

Keywords: chemical analysis microtox assay (luminescent bacteria toxicity test) heavy metal sewage sludge leachate

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About author: 李娟英 (1978-), 河北邯郸人, 副教授, 博士, 主要从事海洋化学方面的研究。E-mail: jyli@shou.edu.cn

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