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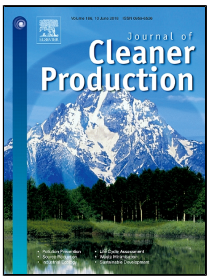


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# Comparative life cycle assessment of sludge management: a case study of Xiamen, China

Xiao Lishan[1,2], Lin Tao[1,2], Wang Yin[3],Ye Zhilong[2], Liao Jiangfu[4]
1.Key Lab of Urban Environment and Health, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen 361021, China;
2. Xiamen Key Lab of Urban Metabolism, Xiamen 361021, China;
3 Key Laboratory of Urban Pollutant Conversion, Institute of Urban Environment, Chinese Academy of Science, Xiamen 36102, China
4 Computer Engineering College, Jimei University, Xiamen, 361021, China.
Corresponding author: Lin Tao. tlin@iue.ac.cn

Abstract: Sludge management poses a great challenge to China's urbanization process as the number of wastewater treatment plants increases and the discharge standards are strengthened. China's sludge production rate is still low compared with developed countries but is undergoing a rapid growth due to increasing urbanization. Sludge management requires a systematic solution which integrates environmental effectiveness, social acceptability, and economic affordability based on a life cycle approach. In this study, we assess the environmental and economic performance of hydrothermal-pyrolysis technology (HPT), an emerging technology for sludge disposal. Climate change, human toxicity, costs, beneficial use of sludge and land occupation are used as indicators to compare HPT with conventional disposal methods, including incineration with two water contents, landfill, and compost. A particle swarm optimization (PSO) model based on the LCA results (PSO-LCA) was built to find a sustainable sludge management system in Xiamen. HPT was the most favorable scenario for sludge disposal overall, but given capacity restrictions and a trade-off between indicators, the optimal disposal proportion was for landfill to account for 9.3% of total sludge disposal, incineration with water content of 80% to account for 35.9%, HPT to account for 28.9% and compost to account for the remaining 25.9%. As further dewatering contributes a significant fraction to human toxicity effects and economic performance, the amount of dewatering should be selected based on the subsequent disposal process. The PSO-LCA method provides scientific evidence to inform decision makers to find a sustainable sludge