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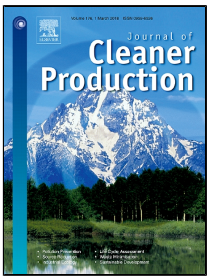

A Systematic Life Cycle Thinking Approach to Develop Sustainable Municipal Solid Waste Management Systems for Developing Countries

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Abstract

Waste management (WM) is a complex sustainability issue because of its intrinsic association with many environmental and economic drivers. Addressing this issue requires clear vision, consideration of the waste life cycle, integrative approaches, and implementation of best-practice WM systems. Therefore, this research aims to present an approach to sustainable management of municipal solid waste in developing countries through systematic life cycle thinking. The study examined the practices in Lebanon as a case study of uncontrolled disposal. The environmental impacts of Lebanon's waste disposal were evaluated to better understand their serious threats. In the next step, 30 alternative WM systems of waste handling were designed. They were assessed for their environmental and economic benefits to demonstrate the proposed approach of developing WM systems and selecting alternatives. The results showed that recycling coupled with composting notably reduces the environmental impacts. It also showed that different waste compositions play a major role in the environmental performance of a WM system, and therefore, they should be considered when developing WM plans. In this regard, high fractions of organic waste are associated with multiple environmental impacts. Such organic waste levels create a challenge for making better use of recycling due to the high amounts in developing countries. Overall, the study concluded that sustainability of WM is a broad concept and should be defined at the local level, with the most pressing environmental issues addressed by each country.