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Community-scale composting for food waste: A life-cycle assessment-supported case study

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ABSTRACT

Community-scale composting, which can be conducted by the local council or a waste management company, is an effective starting point to divert food waste from landfill, especially for developing countries. This paper successfully demonstrates the feasibility of a community-scale food waste composting system, using the University of Nottingham Malaysia as the case study. The method selected is open-air static pile, using food waste as the substrate and leaf-litter as the bulking agent. The composting model presented in this study is also applicable to other organic wastes. The two feedstocks are mixed at a food waste-to-leaves weight ratio of 4: 1 to result in an initial moisture level of 63% and carbon-to-nitrogen ratio of 27. The composting process can be completed in 7 months, yielding about 30 wt % (on dry basis) of compost from the total organic feedstock. The finished compost is shown to meet Malaysia's organic fertiliser standard, thus demonstrating the feasibility of this low-cost technology. Economic analysis showed that substituting chemical fertilisers with the organic compost produced in-house is a viable option, and that for Malaysia, the composting system would be able to self-sustain financially only when the landfilling cost is increased 2.3 times. The life-cycle assessment showed that using composting to replace landfill for food waste, as well as substituting chemical fertilisers with the organic compost produced, can greatly reduce the environmental impacts, especially on global warming, ecotoxicity, eutrophication and fossil fuel depletion. In order to promote the widespread application of composting for organic wastes, multi-actor partnerships are essential to link governments, organisations and households in working toward a circular economy.

1. Introduction

Currently organic waste, particularly food waste, is dealt with inadequately, and in many cases simply disposed of in open dumps or non-sanitary landfills, especially in emerging economies like Malaysia and developing countries (Moh and Abd Manaf, 2017; NSWMD, 2015). This situation brings about numerous environmental and health issues due to the uncontrolled release of contaminants and pathogens. Also, food waste generation is expected to grow exponentially in years to come, while landfill space is in ever shorter supply (Moh and Abd Manaf, 2017).

There are a number of food waste treatment technologies available, such as anaerobic digestion (Zhang et al., 2014), protein recovery treatment (Nguyen et al., 2015), composting (Guo et al., 2018; Cerda et al., 2018), thermal/incineration (Elkhalifa et al.,

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