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Co-Management of Domestic Wastewater and Food Waste: A Life Cycle Comparison of Alternative Food Waste Diversion Strategies

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Abstract

Food waste is increasingly viewed as a resource that should be diverted from landfills. This study used life cycle assessment to compare co-management of food waste and domestic wastewater using anaerobic membrane bioreactor (AnMBR) against conventional activated sludge (CAS) and high rate activated sludge (HRAS) with three disposal options for food waste: landfilling (LF), anaerobic digestion (AD), and composting (CP). Based on the net energy balance (NEB), AnMBR and HRAS/AD were the most attractive scenarios due to cogeneration of produced biogas. However, cogeneration negatively impacted carcinogenics, non-carcinogenics, and ozone depletion, illustrating unavoidable tradeoffs between energy recovery from biogas and environmental impacts. Fugitive emissions of methane severely increased global warming impacts of all scenarios except HRAS/AD with AnMBR particularly affected by effluent dissolved methane emissions. AnMBR was also most sensitive to food waste diversion participation, with 40% diversion necessary to achieve a positive NEB at the current state of development.