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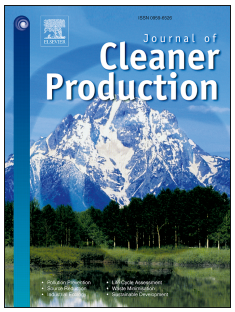

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Emergy Analysis for the Sustainable Utilization of Biosolids Generated in a Municipal Wastewater Treatment Plant

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ABSTRACT

This contribution describes the application of an emergy-based methodology for comparing two management alternatives of biosolids produced in a wastewater treatment plant. The current management practice of using biosolids as soil fertilizers was evaluated and compared to another alternative, the recovery of energy from the biosolid gasification process. This emergy assessment and comparison approach identifies more sustainable processes which achieve economic and social benefits with a minimal environmental impact. In addition, emergy-based sustainability indicators and the GREENSCOPE methodology were used to compare the two biosolid management alternatives. According to the sustainability assessment results, the energy production from biosolid gasification is energetically profitable, economically viable, and environmentally suitable. Furthermore, it was found that the current use of biosolids as soil fertilizer does not generate any considerable environmental stress, has the potential to achieve more economic benefits, and a post-processing of biosolids prior to its use as soil fertilizer improves its sustainability performance. In conclusion, this emergy analysis provides a sustainability assessment of both alternatives of biosolid management and helps decision-makers to identify opportunities for improvement during the current process of biosolid management.

Keywords –Emergy, sustainability, indicator, biosolid, gasification, fertilizer

1. Introduction

In some countries, such as Colombia, domestic wastewater treatment is mostly performed by the use of aerobic processes (Arias & Brown, 2009). Then, the process is complemented by an anaerobic stabilization and biosolids are generated. These biosolids contain a high caloric energy value and polluted organic load (Cherubini et al., 2009). When the biosolids are not properly managed, the wastewater treatment process is inadequate or incomplete (US EPA, 2016). Therefore, sustainable solutions to this problem for achieving greater social and economic benefits with a minimum or zero environmental burden are needed.

To address this solid management problem, there have been implemented various alternatives for the use of these biosolids. Conventionally, alternative solutions such as energy production, building

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