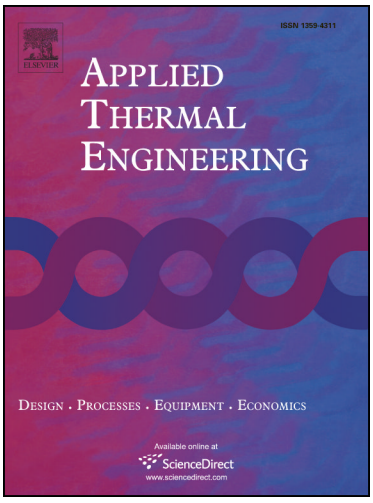

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PII: S1359-4311(17)34568-4
DOI: https://doi.org/10.1016/j.applthermaleng.2018.04.046
Reference: ATE 12043

To appear in: *Applied Thermal Engineering*

Received Date: 11 July 2017
Revised Date: 1 March 2018
Accepted Date: 8 April 2018

Please cite this article as: C.R.S. Rodrigues, T. Machado, A.L. Pires, B. Chaves, F.S. Carpinteiro, A.M. Pereira, Recovery of Thermal Energy Released in the Composting Process and their Conversion into Electricity Utilizing Thermoelectric Generators, *Applied Thermal Engineering* (2018), doi: https://doi.org/10.1016/j.applthermaleng.2018.04.046

Recovery of Thermal Energy Released in the Composting Process and their Conversion into Electricity Utilizing Thermoelectric Generators

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Abstract

This study presents a thermoelectric heat recovery system that harvests energy from the thermal energy released during composting processes. The heat recovery system in this study consists of 120 commercial thermoelectric generators (TEGs), with 0.25 m^2 which was developed in order to obtain an architectural framework with the infrastructure of the composting systems. The electrical outputs of this system were obtained during composting cycle of 33 days, where the electrical outputs varied for different temperature gradients. The TEGs system delivered a voltage of about 11.3 V, a maximum current of 18.5 mA and a maximum power density of 175 mW/m^2 for a load resistance of 500 Ω at a temperature gradient of 20 ºC. This TEGs system displayed a proof-of-concept through the operation which continuous light up a commercial light emitting diodes (LED) strip with 1.5 m of length of 12V, charged three capacitors with individual capacity up to 0.25 F (supercapacitor). The supercapacitor was employed for powering a humidity and temperature sensor with 225 µW/h for 12 minutes.

Keywords: Energy Harvesting; Thermal Energy; Composting Process; Thermoelectric Generator; Heat Recovery

1. Introduction

The exponential increase in the world population and the increase of urbanization have resulted in several negative effects on the environment such as increase greenhouse gas emission, air pollution, as well as contribute to global warming. In particular, the global demand for food and the production of large quantities of animal and solid urban waste are inevitable consequence of today's consumer society [1,2].

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