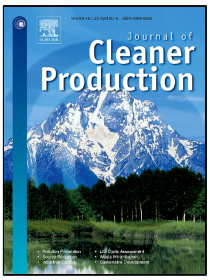
Accepted Manuscript



Food waste recovery into energy in a circular economy perspective: A comprehensive review of aspects related to plant operation and environmental assessment

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PII:	S0959-6526(18)30599-7
DOI:	10.1016/j.jclepro.2018.02.267
Reference:	JCLP 12214
To appear in:	*Journal of Cleaner Production*
Received Date:	22 December 2017
Revised Date:	17 February 2018
Accepted Date:	24 February 2018

Please cite this article as: Carlo Ingrao, Nicola Faccilongo, Leonardo Di Gioia, Antonio Messineo, Food waste recovery into energy in a circular economy perspective: A comprehensive review of aspects related to plant operation and environmental assessment, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.02.267

Abstract

Food Waste (FW) is increasingly viewed as a resource to be diverted from landfilling. In a circular economy where FW management is developed sustainably, FW has great potentials to be recovered, through a set of technologies like Anaerobic Digestion (AD), into high-value energy, fuel, and natural nutrients.

In this context, a comprehensive review of existing life cycle environmental assessments of FW recovery through AD was made and discussed in this paper, with the aim of finding key aspects related to plant operation, as well as to methodology application and Climate Change (CC) impact.

Based upon the papers reviewed, AD resulted to be characterised by a biogas yield being equal to an average of around 120 m^3 t^{-1} FW which increases to around 480 m^3 t^{-1} FW in the case of co-digestion of FW with other biomasses, so underscoring the influence played by the feedstock used.

CC-impact values were found as ranging between nearly -860 and 290 kg CO_2 eq per ton of FW treated in AD, depending upon: the amount of feedstock treated; the amounts of products and by-products and the way they are modelled; and the method used for development of life cycle impact assessment phase.

Results are highly affected by the methodological choices and assumptions that are made as part of the environmental assessment.

Finally, negative CC-impact values were documented to be due to the environmental benefits resulting from the modelling of energy and material substitutes being higher than the environmental impacts associated with the actual treatment system. This is part of the substitution effect which is often considered and recommend in attributional LCAs though, according to this author team could lead to too much emphasising upon the environmental sustainability of AD plants.

Keywords: Food waste; Energy recovery; Anaerobic digestion; Life Cycle Assessment; Environmental Sustainability; Literature review