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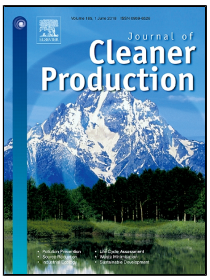

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PII:	S0959-6526(18)31066-7
DOI:	10.1016/j.jclepro.2018.04.053
Reference:	JCLP 12634
To appear in:	*Journal of Cleaner Production*
Received Date:	23 November 2016
Revised Date:	05 April 2018
Accepted Date:	05 April 2018

Please cite this article as: Ali Hussein Sabeen, Zainura Zainon Noor, Norzita Ngadi, Saqer Almuraisy, Ademola Bolanle Raheem, Quantification of Environmental Impacts of Domestic Wastewater Treatment using Life Cycle Assessment: A Review, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.04.053

Quantification of Environmental Impacts of Domestic Wastewater Treatment using Life Cycle Assessment: A Review

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A R T I C L E INFO

Article history:

Keywords:
Life cycle assessment
Wastewater treatment plant
Life cycle impact assessment
Life cycle inventory

A B S T R A C T

Life cycle assessment (LCA) is an analytical tool used to quantify the overall environmental impacts associated with products, processes or human activities from cradle to grave. The LCA is important to determine the impact of wastewater treatment and the technologies used on human health and the environment. It performs well to find the best solutions to improve the sustainability. Therefore, it is important to review how previous studies on wastewater treatment have applied LCA. This paper presents a wide-ranging review of papers published from 1990 to 2016 that have used a range of LCA to cover the objectives, boundaries, functional units (FUs) and life cycle impact assessment (LCIA) of wastewater treatment. The analysis of the reviewed papers revealed that there are some differences in term of the FUs, system boundaries, and LCIA methods. These differences normally contribute to obtaining a few non-prosaic results. Moreover, the FUs adopted in some reviewed studies were not able to achieve the purpose of providing a reference to ensure compatibility of the results. Therefore, it is highly recommended that more attention is paid to choosing the FU in future studies. Thus, to ensure the quality and comparability of LCAs, it is very important to develop the LCA guidelines and standards and the LCIA impact categories.

List of acronyms

ISO	International Standards Organisation	COD	Chemical Oxygen Demand
GHG	Greenhouse gas emissions	BOD	Biological Oxygen Demand
LCA	Life cycle assessment	DO	Dissolved oxygen
LCI	Life cycle inventory	TN	Total Nitrogen
LCIA	Life cycle impact assessment	TKN	Total Kjeldahl nitrogen
GWP	Global warming potential	CH4	Methane
WWTP	Wastewater treatment plant	N2O	Dinitrogen monoxide
EP	Eutrophication Potential	HRT	Hydraulic retention time
AC	Acidification	N	Nitrogen
YW	Yellow water	P	Phosphor
GWR	Grey water reduced scenario	FU	Functional Unit
GW	Greywater	IPCC	Intergovernmental Panel on Climate Change
BL	Baseline	VFCW	Vertical flow constructed wetland
CML	Centre for Environmental Studies, Leiden, Netherlands	PPCPs	Personal care products
TRACI 2.1	Tool for the Reduction and Assessment of Chemical and other environmental Impacts	FEP	Freshwater Eutrophication Potential
		TAP	Terrestrial Acidification Potential
EDIP97	Environmental Design of Industrial Products	HTP	Human toxicity potential
Eco-Indicator 99	Is one of the most widely used impact assessment method in LCA	ODP	Ozone Depletion Potential
ReCipe	Is an impact assessment method which comprises harmonized category	FOFP	Photochemical Oxidant Formation Potential
LIME	Life-cycle impact assessment method based on endpoint modeling	QMRA	Quantitative Microbial Risk Assessment
SBR	Sequence Batch Reactor	SRTs	Solid Retention Times
Fig	Figure	Eq	Equivalent
ASP	Activated sludge process	AN	Ammonia nitrogen

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