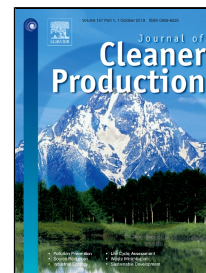


# Accepted Manuscript

Life-cycle Assessment on Food Waste Valorisation to Value-added Products

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PII: S0959-6526(18)32189-9

DOI: 10.1016/j.jclepro.2018.07.199

Reference: JCLP 13653

To appear in: *Journal of Cleaner Production*

Received Date: 21 March 2018

Accepted Date: 19 July 2018

Please cite this article as: Chor-Man Lam, Iris K.M. Yu, Shu-Chien Hsu, Daniel C.W. Tsang, Life-cycle Assessment on Food Waste Valorisation to Value-added Products, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.07.199

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# 1 Life-cycle Assessment on Food Waste Valorisation to Value-added Products

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## 3 Abstract

4 Food waste can serve as a potential substitute for fossil-derived feedstocks for producing value-added chemicals,  
5 such as hydroxymethylfurfural (HMF), yet their environmental performance has not yet been evaluated, thus  
6 impeding informed decision-making. This study aims to develop a life-cycle assessment (LCA) framework to  
7 guide decisions on selecting the most environmentally favourable food waste valorisation option to produce HMF.  
8 A LCA framework was developed to assess the environmental performance of eight food waste valorisation  
9 scenarios with different combinations of solvents, catalysts, and experimental conditions. The environmental  
10 impacts associated with the use of water solvent, organic co-solvents, metal catalysts, as well as the reaction  
11 temperature and time were estimated. Experimental data were analysed for building the life-cycle inventory. The  
12 conversion of bread waste using water-acetone medium with the catalyst aluminium chloride (AlCl<sub>3</sub>), at 140°C  
13 for 30 minutes, was revealed to be the most environmentally favourable food waste valorisation option, due to the  
14 utilization of less polluting co-solvent (acetone) and catalyst (aluminium chloride) as well as the relatively high  
15 yield of HMF (27.9 Cmol%). It is expected that when the development of large-scale valorisation systems become  
16 more mature and information is more readily available, the decision-supporting tool could be expanded to (1)  
17 evaluate the pilot-scale and the industrial-scale of food waste valorisation to HMF, and (2) include the economic  
18 performance of the scenarios so that more comprehensive results could be provided to assist decision-making.

19  
20 **Keywords:** Life-cycle assessment; biomass valorisation; waste recycling; biorefinery; hydroxymethylfurfural;  
21 catalytic conversion.

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