

Accepted Manuscript

Modelling for reactor-style aerobic composting based on coupling theory of mass-heat-momentum transport and Contois equation

Xueqin He, Lujia Han, Jinyi Ge, Guangqun Huang

PII: S0960-8524(18)30047-6
DOI: <https://doi.org/10.1016/j.biortech.2018.01.040>
Reference: BITE 19397

To appear in: *Bioresource Technology*

Received Date: 22 November 2017
Revised Date: 5 January 2018
Accepted Date: 7 January 2018

Please cite this article as: He, X., Han, L., Ge, J., Huang, G., Modelling for reactor-style aerobic composting based on coupling theory of mass-heat-momentum transport and Contois equation, *Bioresource Technology* (2018), doi: <https://doi.org/10.1016/j.biortech.2018.01.040>

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1 **Modelling for reactor-style aerobic composting based on coupling theory of mass-heat-**
2 **momentum transport and Contois equation**

3 *Xueqin He, Lujia Han, Jinyi Ge, Guangqun Huang**

4 Laboratory of Biomass and Bioprocessing Engineering, College of Engineering, China
5 Agricultural University, Beijing 100083, China

6 **Abstract**

7 This study establishes an optimal mathematical modelling to rationally describe the dynamic
8 changes and spatial distribution of temperature and oxygen concentration in the aerobic
9 composting process using coupling mass-heat-momentum transfer based on the microbial
10 mechanism. Two different conditional composting experiments, namely continuous aeration and
11 intermittent aeration, were performed to verify the proposed model. The results show that the
12 model accurately predicted the dynamic changes in temperature (case I: $R^2 = 0.93$, RMSE = 1.95
13 K; case II: $R^2 = 0.86$, RMSE = 4.69 K) and oxygen concentration (case I: $R^2 = 0.90$, RMSE =
14 1.26%; case II: $R^2 = 0.75$, RMSE = 2.93%) in the central point of compost substrates. It also
15 systematically simulated fluctuations in oxygen concentration caused by boundary conditions
16 and the spatial distribution of the actual temperature and oxygen concentration. The proposed
17 model exhibits good applicability in simulating the actual working conditions of aerobic
18 composting process.

19 **Keywords:** Aerobic composting; Modelling; Transfer; Contois; Momentum; Aeration

* Corresponding author. Tel: 86-10-6273-6778; Fax: 86-10-6273-6778; E-mail: huangqun@cau.edu.cn

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