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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

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

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Abstract

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

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

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