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Composting kinetics in full-scale mechanical–biological treatment plants

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ABSTRACT

This study focuses on the investigation of the kinetics of municipal solid waste composting in three full-scale mechanical–biological treatment (MBT) plants. The aims were to test a kinetic model based on volatile solids (VS) content change for describing the composting process in MBT plants, and to identify the model parameters that affected the estimation of the reaction rate constant most. To achieve this, VS content and several environmental conditions, namely temperature, moisture content, oxygen concentration and total bulk density were monitored throughout the composting process. Experimental data was fitted with a first-order kinetic model, and a rate constant (k) characteristic of composting under optimum environmental conditions was obtained. The kinetic model satisfactorily described the experimental data for the three MBT plants. k values ranged from 0.043 ± 0.002 d^{-1} to 0.082 ± 0.011 d^{-1}. Sensitivity analysis showed that the model parameters that most affected the estimation of k were the initial biodegradable volatile solids content, the maximum temperature for biodegradation and the optimum moisture content. In conclusion, we show for the first time that full-scale MBT plants can be successfully modelled with a composting kinetic model.

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