

Modelling In-vessel Composting Under Difference Bulking Agents

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Abstract

Home and community composting of food waste, an essential component of every bio-waste management strategy, is gradually succeeded by in-vessel composting which allows a more efficient and hustle-free process, especially in the urban environment. While in-vessel, or otherwise autonomous composting units (ACUs) solve most of the technical problems associated with home composting, the non-standard characteristics of bulking agents introduce uncertainties which are difficult to quantify during the composting phase. Here we model the behavior of 5 different bulking agents that are typically used in ACU applications in Mediterranean countries as they are readily available or they can be produced using a commercial wood-chipper: wood chips (WC), wood shavings (WS), pine bark (PB), wood pellets (WP) and olive leaves and cuttings (OC). Bulking agent samples were analysed for their content in soluble (Ss), hemicellulose/cellulose (Sc), lignin (Sl), inert substrate (Si), and moisture (Ws) after Sluiter et al. (2010). Mix ratios of food waste vs bulking agent were used to produce mixtures and end-mixture physical properties (density and moisture) were estimated. Variables were introduced to in-vessel composting model of Woodford (2009), modified to match the specifications of an experimental 3 m³ ACU constructed by Dialynas S.A. Results show that at a 1:1 ratio, all bulking agents except WP reached temperatures over 50 °C for a total period of over 4 days. WS, followed by PB, were the quickest to reach temperatures over 50 °C, in 102 and 114 hours respectively, with maximum temperatures reaching 56.3 and 58.1 °C, respectively. Results were successfully validated in the experimental ACU.

Keywords: Autonomous Composting Units

References

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