Effect of Ca (OH)2 dosing on thermophilic composting of anaerobic sludge to improve the NH3 recovery

ABSTRACT

The primary biological treatment method for organic sludge is composting and/or anaerobic digestion, but their product (compost or biogas) is of little economic benefit; therefore, an improved process to produce a high-value product is required to make sludge management more sustainable. Maximizing NH3 gas recovery during composting processes has the potential benefit of producing high-value microalgal biomass. However, the majority of produced ammonia does not evaporate as NH3 gas but retains as NH4+-N in the compost after fermentation. The present study investigates the effects of the timing of Ca(OH)2 dosing (on days 2, 5, and 9), and the Ca(OH)2 dose (1.1–2.6 mmol/batch), on lab-scale thermophilic composting of anaerobic sludge. The effects on NH3 recovery, organic matter degradability, and microbial activity are evaluated. Ca(OH)2 dosing immediately improved the emission of NH3, with yields 50–69% higher than those under control conditions. The timing of the dosing did not influence NH3 recovery or organic matter degradability. Higher Ca(OH)2 doses resulted in higher NH3 recovery, while microbial activity was temporarily and marginally inhibited. The pH of the compost reached 10–11.5 but quickly dropped to 8–8.5 within a day, probably because of neutralization of Ca(OH)2 by the emitted CO2 and release of NH3, which maintained the microbial activity. The present study indicated that Ca(OH)2 dosing would be useful to apply during thermophilic composting for NH3 recovery to cultivate high-value microalgal biomass, which enables this process to obtain a more economic benefit.

Keyword: Composting; Anaerobic sludge; NH_3 recovery; $Ca(OH)_2$ dose; Nitrogen mass balance