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Effects of temperature on hydrolysis performance and short-chain fatty acids production during thermophilic micro-aerobic fermentation of waste activated sludge

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ABSTRACT

Rapid hydrolysis of waste activated sludge (WAS) can be achieved by improving activities of extracellular enzymes under proper temperature conditions. As short-chain fatty acids (SCFAs) accumulation is always consumed by methanogens under anaerobic conditions, and considering that the micro-aerobic condition can inhibit the activities of methanogens, in this study, effects of temperature (55–75˚C) on thermophilic micro-aerobic fermentation of WAS were investigated. Results showed that the highest soluble chemical oxygen demand (SCOD) yield was obtained at 60˚C (4,407 ± 80 mg/L, 36 h), 2.0 times higher than that obtained at 75˚C (2,180 ± 40 mg/L, 36 h), the corresponding hydrolysis rate was 0.6689 d^{-1}. The highest SCFAs yield was 2,928 ± 12 mg COD/L at 60˚C and 36 h, 4.9 times higher than that obtained at 75˚C (594 ± 10 mg COD/L, 36 h). The analysis of SCFAs composition showed that acetic acid (HAc) accounted for the most percentage (>40%), followed by n-valeric (n-HVa) (20–25%), and propionic acids (HPr) (10–15%). Total suspended solids removal efficiency reached 18.7% after 192-h fermentation at 60˚C. These results suggested that the optimal thermophilic micro-aerobic conditions for WAS hydrolysis and SCFAs accumulation from WAS were 60˚C and 36-h fermentation time.

Keywords: Hydrolysis; Waste activated sludge (WAS); Temperature; Short-chain fatty acids (SCFAs); Thermophilic micro-aerobic fermentation

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