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Enzymes catalyzing pre-hydrolysis facilitated the anaerobic fermentation of waste activated sludge with acidogenic and microbiological perspectives

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Abstract: This study investigated acidogenic and microbiological perspectives in the anaerobic fermentation (AF) of waste activated sludge (WAS) pre-hydrolyzed by enzymes catalysis. The enzymes catalysis boosted WAS biodegradability dramatically with nearly 8500 mg/L soluble chemical oxygen demand (SCOD) increase just within 4 h. The volatile fatty acids (VFAs) in acidogenesis were accumulated effectively with over 3200 mg COD/L in 12 d, which reached 0.687 kWh/Kg VSS electricity conversion efficiency (2.5 times higher than the control test). The fermentation process favored the compression of fermentative sludge with the distribution spread index (DSI) rising. The core populations of bacteria and archaea shifting enlarged the dissimilarity of communities at different fermentation stages. Increase of community diversity contributed to VFAs accumulation stability. Moreover, the intermediate bacterial community evenness favored VFAs accumulation potentially. The enzymes catalysis might be a promising solution for strengthening VFAs accumulation and potential electricity conversion efficiency in WAS fermentation.

Keywords: Anaerobic fermentation, Enzymes catalysis, VFAs accumulation, Energy conversion efficiency, Diversity and evenness, Impact factors