Process assessment associated to microbial community response provides insight on possible mechanism of waste activated sludge digestion under typical chemical pretreatments

Current studies have employed various chemicals for disintegrating and hydrolyzing microbial cells in waste activated sludge (WAS). However, a comprehensive process assessment over the whole anaerobic digestion process has seldom been proposed. Besides, the characterization of microbial community responses to these chemicals is not well understood. In this study, the effects of five typical chemicals: solubilizer (β-cyclodextrin, CD), alkaline (NaOH), peroxide (peracetic-acid, PA), biological (rhamnolipid, RL) and chemical (sodium dodecylsulphate, SDS) surfactants on WAS digestion were examined. Higher efficiencies of WAS solubilization, hydrolysis and acidification were achieved by CD treatment, followed by RL and SDS. Methanogenesis was also strongly chemicals-dependent. Shifts in microbial community structure were observed in all chemical-pretreated WAS. The community in RL, CD and PA was dominated by microorganisms that anaerobically hydrolyze organics to acids, while that in NaOH and SDS was mainly associated to biogas production. This study proved that the overall performance of WAS digestion was substantially depended on the initial chemical pretreatments, which in turn influenced and was related to the microbial community structures. Although the economic advantage might not be clear yet, the findings obtained in this work may provide a scientific basis for the potential implementation of chemicals for WAS treatment.