Understanding how the polyaluminum chloride affects anaerobic fermentation of waste activated sludge for short chain fatty acid production

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Abstract:Anaerobic fermentation of waste activated sludge for short chain fatty acid (SCFA) production is one of the important means of sludge treatment. And the polyaluminum chloride（PAC）is added during the wastewater treatment and sludge dewatering process, so that the PAC is accumulated in waste activated sludge at high levels.However, the details of how PAC in waste activated sludge affects SCFA generation from the fermentation remain largely unknown, which provides limited understanding of the fermentation process. This work aims to reveal the impact of PAC dosage on SCFA production from sludge anaerobic fermentation. The results showed thatthe presence of low level of PAC (10-150 mg Al/gTS) have the inhibit effect of SCFA production, while when the amount of PAC added was higher than 200 mg Al/gTS, the SCFA production increased correspondingly. Mechanism investigations showed that low level of PAC is beneficial to the accumulation of sludge flocs and leads to more loose and tightly bound extracellular polymer remaining in the sludge cells. While high level of PAC makes the sludge floc structure loos, which not only accelerated the release of soluble substances from waste activated sludge and disruption of both extracellular polymers and cell envelopes in sludge but also promoted the conversion of protein released from the disintegration process, thereby causing more substrates for SCFA production. Also, the relative activities of key enzymes with hydrolysis and acidification of organic matters were improved .Finally, one strategy that could effectively mitigate the adverse impact of low PAC levels and promote the beneficial impact of high PAC levels on SCFA production was proposed and examined. This work provides insights into PAC-present sludge fermentation systems, which may be practical to reduce both operation and sludge transport and disposal costs simultaneously of wastewater treatment plant. And the findings obtained may guide engineers to manipulate sludge treatment systems in the future.