Effect of the dosage of ferroferric oxide on batch anaerobic treatment of high strength synthetic wastewater

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Received 23 November 2016; Accepted 23 March 2017

\textbf{ABSTRACT}

Direct interspecies electron transfer (DIET) plays an important role in anaerobic wastewater treatment processes, and the dosage of conductive materials can enhance DIET. In this study, tryptone and starch were used to acclimate anaerobic sludge with different microbial communities. Then, the effect of ferroferric oxide (Fe$_3$O$_4$) dosage on batch anaerobic treatment of synthetic wastewater was examined. During methanogenesis for the tryptone acclimated anaerobic sludge, the lag phase was shortened, and the maximum methane (CH$_4$) production rate was increased with the dosage of Fe$_3$O$_4$. While for the starch acclimated anaerobic sludge, the CH$_4$ production was less affected by the dosage of Fe$_3$O$_4$. Furthermore, the dosage of Fe$_3$O$_4$ had limited effects on both hydrolysis/acidification of tryptone and methanogenesis of acetate for the tryptone acclimated anaerobic sludge. Methanosarcina (66.28\% of archaea) and Methanosaeta (19.56\% of archaea) were detected methanogens in the tryptone acclimated anaerobic sludge, which could accept electrons via DIET. While Methanobacterium (92.80\% of archaea) was mainly detected in the starch acclimated anaerobic sludge. Therefore, the effect of Fe$_3$O$_4$ on anaerobic treatment performance was significantly dependent on the organic carbon acclimated microbial communities.

\textbf{Keywords:} Ferroferric oxide; Methanogenesis; Hydrolysis/acidification; Direct interspecies electron transfer

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Presented at the 13th IWA Specialized Conference on Small Water and Wastewater Systems & 5th IWA Specialized Conference on Resources-Oriented Sanitation, 14–16 September, 2016, Athens, Greece.

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