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Responses of anaerobic granule and flocculent sludge to ceria nanoparticles and toxic mechanisms

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Abstract

Effects of CeO₂-NPs on anaerobic fermentation were investigated from the processes of acidification and methanation with anaerobic granule sludge and anaerobic flocculent sludge as the targets. Results showed that acidification process was more sensitive to CeO₂-NPs than methanation process. Both types of sludge produced less short-chain fatty acid compared to the control, with a reduction of 15-19% for the flocculent sludge at the dosage of 5, 50 and 150 mg CeO₂-NPs/g-VSS, and a reduction of 35% for the granular sludge at 150 mg CeO₂-NPs/g-VSS. CeO₂-NPs caused no inhibition to methanation process. Most of CeO₂-NPs distributed on the surface of sludge as revealed by fluorescence labeled CeO₂-NPs. The toxicity of CeO₂-NPs to anaerobic sludge did not result from reactive oxygen species. Physical penetration and membrane reduction may be important toxic mechanisms.

Keywords: ceria nanoparticles; anaerobic granule sludge; anaerobic flocculent sludge; acidification; methanation

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