PD-063:

Detection of Fermentative Dissimilatory Nitrate Reduction to Ammonium Bacteria in Municipal Wastewater Treatment Plants in Japan

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Nitrogen cycle under anoxic environment can be driven by three microbial pathways: denitrification, anaerobic ammonium oxidation (anammox) and dissimilatory nitrate reduction to ammonium (DNRA). Among these, denitrification has long been considered as the major nitrogen transformation process in anoxic environment. Anammox and DNRA, however, have continuously gained more attention due to their dominance and contribution in various ecosystems. DNRA can cause adverse impacts on wastewater treatment plant due to a competition with denitrification and the re-formation of ammonium. The pathway of DNRA can be further classified into two types, which are respiratory DNRA and fermentative DNRA processes. Until now, however, only respiratory DNRA bacteria have been studied extensively for environmental samples. Fermentative DNRA has been given far less interest than the respiratory DNRA type, which could partly due to the lack of primers for the detection and identification of fermentative DNRA bacteria in environmental samples. In this study, primers targeting the gene encoding NADH-dependent nitrite reductase, an enzyme responsible for fermentative DNRA activity, have been designed and evaluated with pure culture strains. We further tested the primers with samples taken from three municipal wastewater treatment plants in Japan that treated wastewater by anaerobic-anoxic-aerobic (A2O) process. The results showed that the designed primers were able to detect gene fragments of the expected size from the tested bacterial strains as well as all the three wastewater sludge samples. The detection of NADH-dependent nitrite reductase gene fragments indicates potential fermentative DNRA activity within these wastewater treatment systems. This result suggests the importance of further investigation to evaluate the extent of fermentative DNRA process and its contribution to the overall nitrogen pathways within the wastewater treatment plant.

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