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**Performances and microbial characteristics of granular sludge for autotrophic nitrogen removal from synthetic and mainstream domestic sewage**

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**Abstract:** The completely autotrophic nitrogen removal over nitrite (CANON) process is an important component of energy self-sufficient sewage treatment plants, and the use of aerobic granular sludge is a profitable choice for the CANON process. In this study, the performance and microbial characteristics of CANON granular sludge were investigated for treating synthetic and mainstream domestic sewage. The average nitrogen removal rate (NRR) was  $3.22 \text{ kg N m}^{-3} \text{ d}^{-1}$  during the high-rate operating period with high MLSS ( $4.09 \text{ g L}^{-1}$ ) and DO ( $\sim 1.0 \text{ mg L}^{-1}$ ) for treating synthetic sewage. When the influent was mainstream sewage, the average NRR was  $1.11 \text{ kg N m}^{-3} \text{ d}^{-1}$ . The effluent nitrate concentration was very low, and nitrate build-up was not found. High-throughput pyrosequencing results indicated that, *Nitrosomonas* and *Candidatus Brocadia* were the dominant genus in ammonia oxidizing bacteria (AOB) and anaerobic AOB (AAOB), respectively. The proportions of AOB and

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