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Applying the denitrification method to ^{15}N and ^{18}O analysis of nitrate in natural groundwater samples

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This study aims to develop a simplified denitrification method for the $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ analysis of nitrate (NO_3^-) in natural groundwater samples following Zhu et al. (Sci Total Environ. 2018; 633: 1370–1378) and Sigman et al. (Anal Chem. 2001; 73: 4145–4153). With the help of *Pseudomonas aureofaciens* bacteria, the simplified method induced denitrification of the sample and completely converted the NO_3^- into measurable N_2O while avoiding sample fractionation. In contrast to the classic denitrification method (Sigman et al., 2001), which is based on anaerobic cultivation, the bacteria are cultivated aerobically in the simplified method (Zhu et al., 2014). In this study, aerobic cultivation was performed in a nitrate-free medium. Unlike the other two methods, aerobic cultivation was performed without the addition or removal of nitrate in the liquid medium. This eliminates the need for another preparation step, saving time. There was no contamination with external NO_3^- . After further optimising the influencing factors, the method yielded high accuracy and precision (standard deviations were generally $\leq 0.7\text{‰}$ for $\delta^{18}\text{O}$ and $\leq 0.3\text{‰}$ for $\delta^{15}\text{N}$), confirming the suitability of this procedure. Finally, the potential applicability of the method was demonstrated by measuring the isotopic composition of NO_3^- in natural groundwater samples.