Nitrogen and oxygen isotope effects associated with a combined partial nitritation-anammox wastewater treatment process

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Nitrogen removal from wastewater is an essential process for preserving the health of aquatic ecosystems. Partial nitritation-anammox has emerged as an innovative approach for accomplishing this while minimizing the requirements for external sources of energy. We present measurements of the nitrogen and oxygen isotope effects produced in nitrate, nitrite, and ammonium by microbial biomass from a pilot partial nitritation-anammox water treatment plant. In particular, we have performed controlled experiments in which the activities of anammox, ammonia oxidation, and nitrite oxidation mix in various proportions. Our results can be used to diaganose the microbial processes underway in such a reactor and to thereby improve its performance at removing dissolved nitrogen species while maintaining energy autarky. In turn, the conclusions from these laboratory experiments can inform the interpretation of isotopic measurements from natural settings where complexity arises from mixtures of the same nitrogen transformations.