169. Microbial Population Dynamics versus Nitrification Performance in Biofilm Reactors operated with different hydraulic Retention Times during a Shift from pure Ammonia Oxidation to combined organic Carbon and Ammonia Oxidation

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[1]University of Minho, Braga, PORTUGAL; [2]Technische Universität München, Munich, GERMANYIn order to improve biological reactors operation and design it is important to study the effects of changes in process parameters with regard to the microbial community structure and, vice versa, the effects of community structure and dynamics on the reactors performance. Two biofilm reactors operated with hydraulic retention times of 1 h and 6 h were used to study the links between population dynamics and reactor operation performance during a shift in process operation from pure ammonia oxidation to combined organic carbon and ammonia oxidation, under oxygen limiting conditions. During the entire experimental period both reactors received identical ammonium and organic carbon loads. The composition of the microbial consortia in both reactors was quantified with rRNA-targeted oligonucleotide probes combined with fluorescence in situ hybridization, confocal laser scanning microscopy, and digital image analysis. Furthermore, fine-scale diversity analyses of ammonia-oxidizers in both reactors were performed using the gene (amoA) encoding the catalytic subunit of the ammonia-monooxygenase enzyme as a marker. The observed population dynamics (microscale phenomena) correlated well with the nitrification performance of the reactors and biofilm parameters like thickness and mass

concentration (macroscale phenomena). The decrease in nitrification efficiency after acetate addition was more drastic in the reactor operated with 6 h retention time due to the unexpected formation of a thicker heterotrophic layer on top of the nitrifying biofilm that increased the resistance to oxygen mass transfer and the nitrifiers became oxygen limited. This fact can probably be explained by the decrease in the shear forces acting in the biofilm caused by the increase in the liquid phase viscosity due to the higher growth of suspended heterotrophic bacteria observed in that reactor.