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MICROBIAL COMMUNITY STRUCTURE IN THE ACTIVATED SLUDGE PROCESS

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EXTENDED ABSTRACT

The activated sludge process is generally difficult to fully comprehend and thus difficult to be effectively operated and controlled. This is partly due to the complex way the sludge communities behave as well as the methodological limitations related to the knowledge on the microbiology of this process. Traditional methods to investigate the microorganisms in wastewater include standard light microscopy and classic approaches based on cultivation and isolation (e.g. most probable number-MPN and/or plate counts). Only after the introduction of molecular techniques in microbial ecology during the last decade, it became possible to determine to some extend the composition and dynamics of microbial communities in these systems and to identify the key players for the different process types.

Till today engineers commonly accept the physico-chemical environment as the main cause of sludge community structure. However, more complex modes of operation and prolonged biomass retention times allow the development of the more slowly growing protozoa and even metazoa. Therefore, the potential impact of grazing on bacteria by these microorganisms might be grossly neglected. The exploitation of basic scientific knowledge gained from the field of microbial ecology can be extremely beneficial in unveiling the structure and function of sludge microbial community in order to optimize plant operation and performance.

In this work, an attempt has been made to open the “black box” of the sludge community in a way similar to the aquatic systems. The microbial community consisted of three trophic levels. Bacteria form the first level (P1), protozoa and rotifers, as bacteria predators, the second level (P2), while aquatic insects and carnivorous protozoa, as top predators, the third level (P3). Community structure fluctuated rather independently of operational parameters. Moreover, low SVI and nitrification coincided with high protozoa abundance. This challenges the classic thesis of steady state conditions and of bottom-up regulation of the sludge communities. Therefore, the role of rotifers and aquatic insects, besides protozoa, in shaping and functioning of the sludge community might be more important than it was though before. Those phenomena support thehypothesis that sludge community is shaped at times by top-down regulation as well.

Key words: wastewater treatment, microbial community, indicators of quality, protozoa, rotifers, bottom-up regulation, bottom down regulation