FUNCTIONAL SINGLE CELL ANALYTICS – STUDYING DNA PATTERNS AND DYNAMICS OF POLYPHOSPHATE ACCUMULATING BACTERIA IN WASTE WATER COMMUNITIES

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Abstract

The still poorly explored world of microbial functioning is about to be uncovered by a combined appliance of old and new technologies. Especially bacteria are still in the dark both in view of their phylogenetic affiliation as well as their metabolic capabilities and functions. However, with the advent of sophisticated flow cytometric and cell sorting technologies in microbiological labs there is now the possibility to gain this knowledge without cumbersome cultivation approaches on the single cell level. Waste water treatment plants with enhanced biological phosphorus removal (EBPR) represent a state-of-the-art technology. Nevertheless, the process of biological phosphate removal is prone to occasional failure. One reason is the lack of knowledge about the structure and function of the bacterial communities involved. Determination and quantification of phosphate accumulating organisms in highly diverse bacterial communities like activated sludge are of high interest because of the need for improved and untoxic phosphorus removal from domestic waste water. Here, flow cytometry was used to identify bacteria capable of polyphosphate accumulation within such complex environments. A novel fluorescent staining technique for the quantitative detection of polyphosphate granules on the cellular level was developed. The dynamics of cellular DNA-contents and cell sizes as growth indicators were determined in parallel to detect the most active polyphosphate accumulating individuals/sub-communities and to determine their phylogenetic affiliation upon cell sorting. The procedure is easy to perform, quick and cultivation-independent. We aim at combining this technique with phylogenetic analyses to give an on-line tool for monitoring EBPR stability and forming a basis for development and optimization of waste water process control.

Keywords: Bacteria, DNA patterns, polyphosphate accumulating bacteria, waste water

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