

ConAn – a new software for 3-d multi-parameter analysis of microbial biofilm images collected by laser scanning microscopy

Thomas R. Neu, Barbara Zippel, Christian Staudt
Department of River Ecology
UFZ Centre for Environmental Research Leipzig-Halle
Brueckstrasse 3a, 39114 Magdeburg, Germany
E-mail: thomas.neu@ufz.de

Key words: laser scanning microscopy, digital image analysis, software, biofilm images

Laser scanning microscopy (LSM) is an indispensable tool for studying structure, function and processes in microbial biofilms. In order to evaluate 3-dimensional microbiological data sets special programs for digital image analysis are needed. Ideally the data sets should be visualized, quantified and their structural parameters calculated. In addition, the analysis should be automatically in order to allow throughput of many image series. For this purpose, usually different types of software have to be used. Confocal Analysis (ConAn) is a new combined application running under IDL which was developed specifically for the analysis of microbiological LSM data sets. ConAn comprises the following features: analysis of multi-channel data, various mathematical filter options, six different thresholding methods, calculation of co-localization, object recognition, volumetric analysis, calculation of structural parameters, manual and batch processing. The program allows calculation based on the whole image (8) and on single objects (10). In addition, two specific macros were defined for analyzing 1) cell and polymer distribution in bacterial biofilms including object relationship and 2) bacterial, cyanobacterial, algal and polymer distribution in mixed phototrophic biofilms including co-localization. In this study the ConAn program was used to analyze these two types of biofilm data sets in order to evaluate the different software options. Initial results showed the suitability for automatic volumetric calculations and step by step visualization of the analysis including object recognition. Nevertheless, the analysis of biofilm structural parameters is still a challenging task and may need further investigation. In conclusion, ConAn represents a very powerful program for 3-dimensional biofilm image analysis combining all necessary tools for multi parameter calculations.