



Droplet-based microfluidics for exploring soil bacterial diversity

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Abstract:

The transition to a complete sustainable economy demands not only for a CO₂-neutral energy production, but also for closed loops in material processing. This challenge cannot be met by chemical conversion alone, but has to integrate biotechnology process steps, too. It further development depends on the knowledge and exploration of natural microbial resources, which are an invaluable, but widely non-discovered natural treasure, up to now. Conventional cultivation methods are limited in their ability to make the huge unknown variety of natural microbial communities accessible. In particular, methods for high sample throughput and massive parallel cultivation and testing of larger parameter spaces are needed.

Droplet-based microfluidics allows the parallelization of tiny cultivation volumes for large sets of microorganisms. It is possible to investigating the formation of microbial colonies by dilution of unknown communities down to the single-cell level using the principle of “stochastic confinement”, on the one hand, and for analysing the response of microbial populations on environmental pollutions, drugs or even special substrates, on the other hand. The so-called “segmented flow technique” is particular suited for studying the concentration-dependent microbial response on concentration of special components, supplies highly-resolved dose/response functions and maps of combinatorial effects of toxins.

These techniques have been applied for investigating soil samples from special environments, as mining areas, smelting places and archaeological sites. In result, very



different soil bacterial communities have been detected and characterized in their chemical response behaviour, new interesting species can be found and new bacterial strains of known species with unknown special physiological properties have been isolated.

Biography:

J. Michael Köhler is the head of the Department of Physical Chemistry and Microreaction Technology at the Technical University of Ilmenau (Germany) since 2001. He studied Chemistry in Halle an der Saale and Jena, where he also habilitated in General and Physical Chemistry (1992). He led a research department at the Institute of High Technologies in Jena between 1991 and 2001. During this time, he also taught at the Universities of Wuppertal and Jena. Professor Koehler inter alias has edited books on microlithography, micro system technology and nanotechnology. His current research interests are focussed on nanotechnology, on application of droplet-based microfluidics in

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