

Microbial biostabilization and flocculation – what can we learn for sediment transport modelling?

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ABSTRACT

Over the last years, microbial biostabilization of fine sediments has received great attention since it impacts significantly all parts of the ETDC (Erosion, Transport, Deposition, Consolidation) cycle (reviewed in Underwood and Paterson 2003, Gerbersdorf and Wieprecht 2015). While the focus has been on marine habitats, the enhanced stability of sediments due to biofilm growth has been reported from freshwaters recently (e.g. Schmidt et al. 2015). However, little is known about the influence of ubiquitously occurring microbes on the characteristics of resuspended sediments. In numerical modelling, the suspended sediment is still regarded as single mineral grains despite better knowledge on the complex composition of natural flocs (Droppo 2001).

Experiments were conducted in mesocosm to grow biofilm under natural but controlled conditions by circulating river water over test sections. The growing biofilms were exposed to varying conditions of hydrodynamic and their development monitored regularly (biomass, species composition, Adhesion and stability). After six weeks, the biofilm – stabilized sediments were eroded in the Gust Chamber (Fig. 1), transferred to a settling column (height of 32.7cm) and recorded by a Charged Coupled Device CCD camera (photo taken every 12 seconds, Set-up in Fig. 2) during their settling process. Image analysis by Matlab has been used to evaluate geometrical properties of the eroded flocs such as form factor, aspect ratio, Corey shape factor, roundness, solidity, equivalent diameter and perimeter. Additionally, the settling velocity as well as the density, dry weight and organic content of the flocs have been determined.

This presentation will show the results on eroded sediment floc characteristics and relate them to the previous biofilm growth conditions or the “bed history” such as varying hydrodynamics. The data will be opposed to the behavior of single mineral grains.

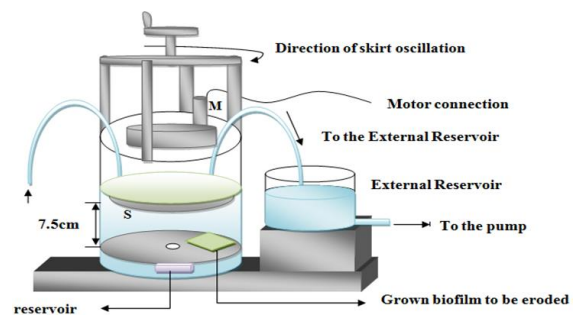


Figure 1. Gust Microcosm

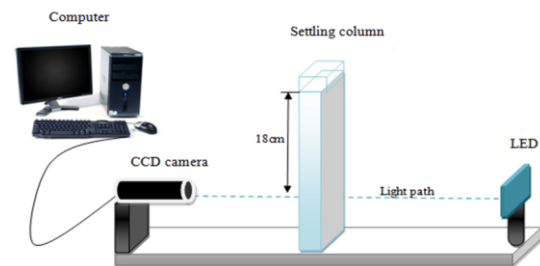


Figure 2. Set-up of settling column and CCD camera

In particular, the significance of these data will be discussed in terms of natural sediment transport and deposition. Implications for modeling the dynamics of fine sediments will be highlighted.

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