

Bio-Engineering for Sediment Management And Removal of Turbidity Technologies: introduction, need, and research - implementation gap

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Introduction: In this paper we introduce the Bio-Engineering for Sediment Management And Turbidity Removal Technologies (BESMART Technologies). BESMART Technologies make use of natural processes to achieve engineering goals in the context of fine sediment management operations. These constitute a novel research portfolio at Deltares, where close collaboration with Haedes takes place in the context of a number of these technologies.

The need for (fine) sediment management innovative solutions: The management of fine sediment remains one of the major concerns for river managers and port authorities throughout the world. For instance fluid mud remains both a scientific as well as operational challenge in estuaries and harbors (De Sutter et al., 2013). Though sustainable solutions are being developed and interesting pilots and case studies (e.g. Laboyrie et al., 2018; Sittoni et al., 2019) are being carried out in this context, dredging and beneficial re-use of sediment still remain an open subject for research and optimization. Dewatering of dredged material in lagoons, habitat creation by depositing fine sediment in open water, land reclamation projects, or the development of additional habitat for coastal vegetation, are other examples where cost-efficient and sustainable solutions are of need.

Overview of current BESMART Technologies: BESMART Technologies are meant to be a sustainable and cost-effective alternative for traditional sediment management techniques (e.g. chemical flocculants, drains, compaction, etc). Scientists from Deltares are developing these innovative and naturally based technologies dedicated to the management of the finest and most challenging fraction of soft sediments. So far, the majority of the developments had taken place in the laboratory. Apart from their obvious savings (these interventions are mostly natural and therefore passive) and environmental care, these technologies all take a real and sound technical ability to solve sediment management issues as their starting point. In fact, they all have a very specific technological goal. The technologies and their specific engineering goal are:

- A) worms for soft sediment dewatering and strengthening, (Yang et al., 2019, 2020)
- B) algae as a bio-flocculant,
- C) Kaumera® as a bio-flocculant,
- D) *Beggiatoa* (bacteria mats) as bed protection, and

- E) vegetation for mud dewatering, strengthening and bed protection.

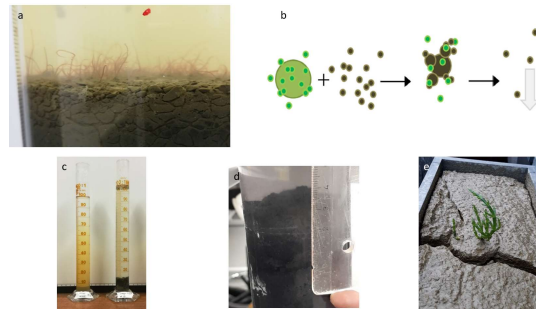


Figure Error! No text of specified style in document.. Overview of the BESMART Technologies as discussed in this paper.

The gap between laboratory and meso scale research and actual field applications: Notwithstanding the promising results on lab scale of the different BESMART Technologies mentioned, several hurdles still need to be taken in order to implement the different bio-engineering options mentioned above. Meso scale research to assess 3D and operational parameters effects, and parallel research instruments like modelling, need to be further developed in order to optimize re-use scenarios in project planning. More research is also needed to capture potential and still unrevealed side-effects on the local environment in the given economical setting. Actual field testing will allow to deliver industrial work flows for different re-use applications, optimize operational procedures and give responses to health & safety questions.

References:

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