Heterogeneous flocculation combining the biological and mineralogical populations in a marine and coastal environment: literature study for a conceptual model

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The biological population dynamics (e.g. algae bloom) have been concerns of biologists and ecologists, whereas the sediment dynamics have been interest of geologists and hydraulic engineers, in a marine and coastal environment. The biological and mineralogical populations seem separate in different fields of study. Recent studies however have found that heterogeneous flocculation can integrate both the seemingly separate populations for combining the biological and mineralogical populations in a bio-mineral floc. Therefore, the literature study was aimed to investigate heterogeneous flocculation, in which the biological and mineralogical populations are the heterogeneous fractions for building a bio-mineral floc. The following are the important findings from the literature study. (1) The biological population exudes sticky extracellular polymeric substances (EPS) and transparent exopolymeric substances (TEP) which can bind biological and mineralogical particles together in a bio-mineral floc (e.g. Passow, 2002). (2) The amount of EPS and TEP depends on the competitive microbial population dynamics between phytoplankton, zooplankton and bacterioplankton in a marine and coastal environment and consequently determines the stickiness (i.e. flocculation capability) of biological and mineralogical particles (e.g. Jackson and Checkly, 2011). (3) The biological population finally becomes a less-dense amorphous part in a floc and affects the size and morphology of bio-mineral flocs, but the mineralogical population provides ballasts in a floc and determines floc density and settling velocity (e.g. Droppo, 2001; Ploug *et al.*, 2008). In fact, the biological and mineralogical populations attach each other and build a bio-mineral floc with the medium of EPS and TEP, due to heterogeneous flocculation in a marine and coastal environment. Further, the mineralogical composition is heterogenous and may change according to hydrodynamic conditions and seasons. Finally the conceptual model of heterogeneous flocculation in this literature study will be refined and simplified for developing the mathematical model, based on the TCPBE model of Lee *et al.* (2011)

References

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