

## **Reviewer 1 – Trevor Tolhurst**

*Specific comments:*

*Synthetic is used to describe the EPS used in this study, but it is not really synthetic – all of them have been extracted from natural sources, could a more accurate term be used?*

We changed 'synthetic' to 'extracted' throughout the manuscript in an effort come up with a more accurate term.

*Page 2, line 12: I don't put a hyphen in microphytobenthos. I would not consider flocs and aggregates to be biofilms because to me a biofilm is a thin layer over a surface (although flocs and aggregates could have a biofilm over their surface).*

We removed the hyphen in microphytobenthos and deleted flocs and aggregates.

*Page 3 lines 2-3: the terms 'microbial mats' and 'biofilms' are often used interchangeably, the former is not exclusively used to denote a covering of underlying sediments, and the latter is not exclusively used to denote coatings of single grains. In my own work, I use biofilm to denote a visible (either by eye or microscopically) layer of microphytobenthos on a sediment surface.*

Thank you for pointing this out. We added this clarification to the manuscript (P3, lines 5 -7).

*Page 3 lines 10-13: there are also examples of buoyant biofilms, which reduce the erosion threshold of sediments (e.g. Sutherland, T. F., C. L. Amos, and J. Grant. "The effect of buoyant biofilms on the erodibility of sublittoral sediments of a temperate microtidal estuary." *Limnology and Oceanography* 43.2 (1998): 225-235; and Tolhurst, T. J., M. Consalvey, and D. M. Paterson. "Changes in cohesive sediment properties associated with the growth of a diatom biofilm." *Hydrobiologia* 596.1 (2008): 225-239).*

We added this information and the associated references to the manuscript (P3, lines 15 -17).

*Page 5 line 14: to clearly differentiate from the synthetic EPS, I would insert 'diatom' before 'biofilm-secreted'.*

Done

*Page 7 line 20 and throughout: change 'Soil' to 'Sediment'. For me the sand used in this work is not a soil.*

Done

*Page 9 line 20: being precise, test Sand 7 increments in 2.068 kPa steps, but this probably doesn't matter too much given the error in the actual pressure of the CSM jet.*

We corrected this information.

*Page 12 line 20: I'm not entirely sure what is meant by 'floated around the substrate' do you mean the diatoms were motile and not attached to the sediment grains?*

Yes indeed, that is what we meant to say. We rephrased to clarify the explanation, following the reviewer's suggestion (P13, lines 12-13).

*Page 15 lines 9-10: I'm not entirely sure what is meant by 'Added', can the authors clarify?*

We removed 'added' here and also in section heading 3.2.

*Page 24 line 6: this reads oddly 'non-room temperature test conditions of 20° isn't 20° room temperature? Should this be conditions of 10 and 40°?*

We rephrased this sentence to correctly represent the temperature conditions (P25, lines 5-7).

*Page 25 Table 2: 'Relative biostabilisation' was termed 'biostabilisation index' by Manzenreider, consider using this terminology instead (Manzenrieder, H. "Retardation of initial erosion under biological effects in sandy tidal flats." 1985 Australasian Conference on Coastal and Ocean Engineering. Institution of Engineers, Australia, 1985).*

We changed 'relative biostabilisation' to 'biostabilisation index' in Table 2 in incorporated the citation to the work of Manzenreider (1985).

*Page 28 lines 18-19: This is interesting. I looked at the effects of letting diatom biofilms grown on sand drain and 'dry' out for a few hours in my PhD. There were changes in the erosion threshold and some indication that drier samples had a lower erosion threshold, but the effects were largely masked by variability in the biofilms. It is quite possible that the decrease in erosion threshold seen with time in this study is at least partly due to the successive drying. It seems quite likely to me that as EPS dries out it will become less effective at stabilising sediment, but as you say, it needs more research.*

Thank you for sharing your experiences on this topic. In our study, the engineered samples with repeat measurements over time showed different behavior after re-wetting the sediment. This may be due to a dilution effect of the EPS, the successive breakdown of the EPS over time, or some other unknown process associated with the successive drying. It would be insightful to further investigate this topic in future work.

*Technical corrections:*

*Page 8 line 9: change 'weighted' to weighed'.*

*Page 15 line 10: the 'Added' on line 10 should have a lower case A.*

*Page 21 line 10: insert a comma after 'Gum'.*

*Page 24 line 14: change 'linear' to 'linearly'.*

*Page 28 line 13: delete second full stop.*

*Page 30 line 14: insert a comma after 'controllable'.*

All done.