Turbulence induced Transparent Exopolymer Particle (TEP) production by a marine diatom, *Chaetoceros tenuissimus*

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Large amounts of TEP were produced and visible aggregates formed when diatom cultures were rolled

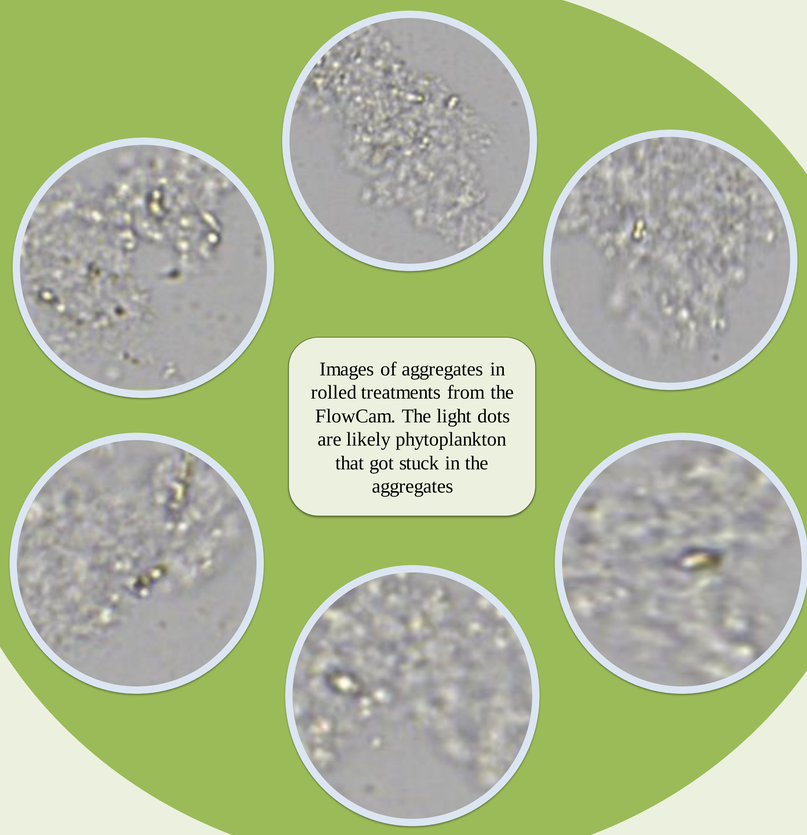
Background

- Phytoplankton are aquatic microorganisms capable of photosynthesis
- Transparent exopolymer particles (TEP) are made up of polysaccharides that are exuded by phytoplankton
- TEP are sticky and form carbon rich marine aggregates, also referred to as marine snow
- Diatoms, a group of phytoplankton, are known to produce large amounts of TEP, especially under turbulent conditions
- Carbon rich marine snow becomes weighted as heavy phytoplankton cells and other material sticks to these aggregates, which increases aggregate sinking speed
- Increased sinking speed may enhance carbon storage in the ocean
- This research is important as TEP plays an important role in the marine carbon cycle

How do we make transparent exopolymer particles (TEP) in the lab?

Methods

- Cultures of *C. tenuissimus* were grown in f/2 media
- 3 replicates of *C. tenuissimus* culture were place on a bottle roller at 1 rpm and incubated at 15°C under a 12-hour light cycle
- 25 mL of culture was filtered using a 0.4 µm polycarbonate filter. 500 µL AB dye was passed through the filter.
- Filters placed in scintillation vials with sulfuric acid for 2 hours, and agitated every 30 minutes
- Absorbances were read with the spectrophotometer
- TEP in µg XGeq. L^{-1} were calculated from absorbances using: $TEP = (TEP_{abs} \bullet f)/(V/1000)$
  where TEP_{abs} is the absorbance, f represents f-value which is 1/slope of the alcian blue calibration curve, V is volume filtered in mL.



Images of aggregates in rolled treatments from the FlowCam. The light dots are likely phytoplankton that got stuck in the aggregates

Results

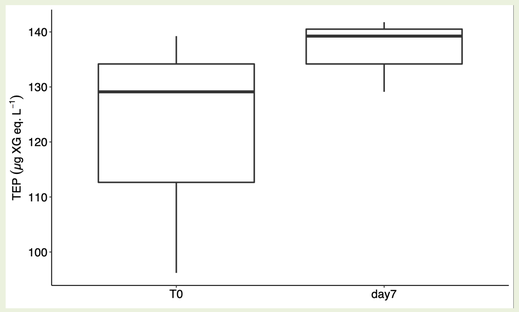


Figure 1: Box plot of TEP concentrations (µg XG eq. L^{-1}) with no cells at initial time and on day 7 of being rolled. P-value = 0.45

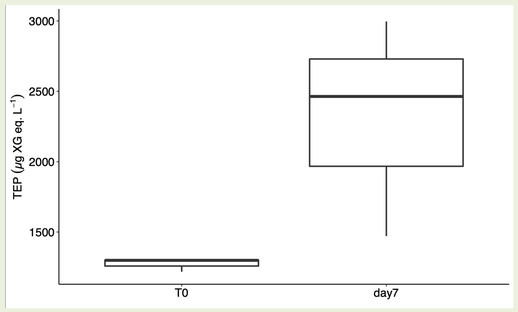


Figure 2: Box plot of TEP concentrations (µg XG eq. L^{-1}) in bottle with *C. tenuissimus* at initial time and on day 7 of being rolled. P-value = 0.096

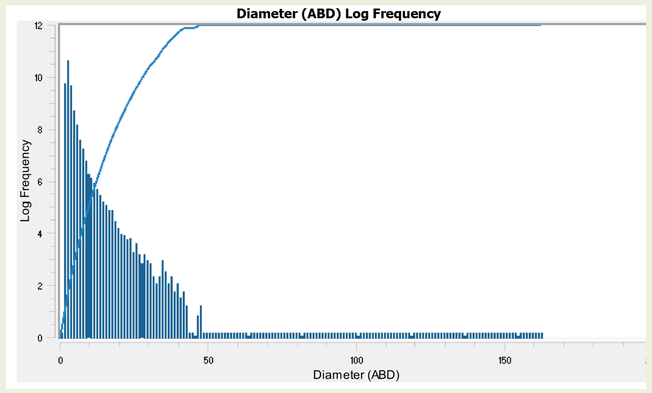


Figure 3: Log Frequency of particle diameter measured using the FlowCam

Conclusions and future directions

- Rolling *C. tenuissimus* increases the amount of TEP produced and leads to visible aggregate formation
- Enhancing TEP production in the laboratory can be used a treatment in future experiments to understand TEP dynamics in TEP rich scenarios
- Next steps to better capture aggregate sizes in different scenarios using the FlowCam

References

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Acknowledgements

Thank you to the Department of Biological Science, the Harvey Lab, and Mikayla Cote.