HOW DOES SYNTHETIC MATERIAL FROM CLOTHING IMPACT ALGAE GROWTH?

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Background

- Many clothes are made from synthetic fibers which increase breathability and elasticity of fabrics. Synthetic fabrics are made from petroleum polymers and when washed they "shed microfibers that add to the increasing levels of plastic in our oceans" that never biodegrade (Perry, 2018).
- Roughly 50 to 85 percent of the world's oxygen comes from the phytoplankton (a.k.a. microalgae) ("How much do oceans add to world's oxygen?", 2015). However, microplastics are degrading ecosystem health by inhibiting vital algae, like phytoplankton, from photosynthesizing (Wu et al., 2019).

Figure 1. Synthetic fibers shed from polyester clothing. Photo by Ocean Wise Conservation Association, 2020.

Motivation

- Algae provides necessary food, shelter and oxygen for many species. When phytoplankton is unable to photosynthesize it can not reproduce at necessary levels, harming aquatic and terrestrial life. Not only does marine life suffer because of this, but humans do too. If the phytoplankton cannot photosynthesize, it cannot produce the necessary oxygen that humans need to survive.
- The use of synthetic material is widespread but the environmental and health impacts are less known. This study will provide valuable information about the effects of synthetic waste on algae, a vital component of aquatic ecosystems.
- **It is essential to understand how microplastic exposure impacts algae health to understand how these processes will impact life on earth.**

Hypothesis

- We hypothesize there is a negative relationship between exposure to synthetic materials and algae growth.

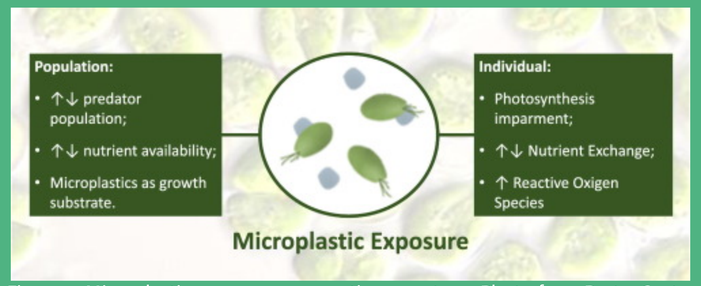


Figure 2. Microplastic exposure on aquatic ecosystems Photo from Prata, Costa, Lopes, Duarte, & Rocha-Santos.

Predictions

- *We predict that synthetic materials will block light inhibiting the algae's ability to photosynthesize.*

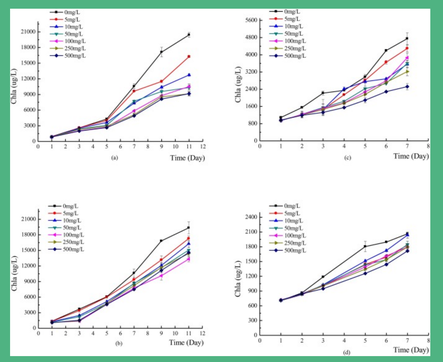
Figure 3. Visualization of Aquarium of Algae as would be used in experiment. Photo from Aquarium Filter Set Up

Study Design

- For our study we will make 10 aquariums with 5 species of freshwater and saltwater algae. For each species of algae, we will add synthetic fiber from common clothing that has been collected from the wastewater from the wash. Half of the tanks will not have added synthetic material. Over 3 weeks, we will measure algae growth and observe overall health of algae in the aquariums recording data every day.

Intended Analysis

- Our analysis will compare algae growth in aquariums containing synthetic fibers to aquariums not containing synthetic fibers.
- We will analyze qualitative differences in the health of the two algae groups like color, robustness, and growth.



This figure shows the effects of microplastic (PVC and PP) on chlorophyll content of two species of algae. As the amount of microplastic increases, the rate of chlorophyll growth generally decreases.

Figure 4. Effect of PVC (a) and PP (b) on the chlorophyll a content (Chla) of *C. pyrenoidosa*. Effects of PVC (c) and PP (d) on the chlorophyll *a* content (Chla) of *M. flos-aquae*. Photo from Wu, Guo, Zhang, Zhang, , Xie, & Deng.

Expected Benefits

- From this study, we will have more knowledge about the effects of microplastic on our aquatic ecosystems.
- This data could support efforts to limit the use of synthetic materials in clothing or sway the public to choose more environmentally friendly choices of clothing. This study would be one of many looking at the effects of plastic on the health of our earth.

Literature Cited: *How much do oceans add to world's oxygen?*. Earthsky.org. (2015). Retrieved from https://earthsky.org/earth/how-much-do-oceans-add-to-worlds-oxygen.

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