Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.14817

Impacts of Polystyrene Nanoplastics on the Cell Surface Properties of Picocyanobacteria *Synechococcus* and Microalgae *Spirulina*

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Plastic debris can undergo degradation processes in aquatic environments to form nano-sized plastic particles, or nanoplastics (NPs), defined as plastic particles less than 1 µm in size. Based on the chemical composition and degradation processes, NPs will vary in morphology and surface charge [1]. There is the potential for electrostatic interactions between positively-charged NPs and charged cell surface of freshwater and marine bacteria. Depending on the NPs surface functionalization and the charge of the cells, the surface interactions can cause the deformation of cell morphology, reduction in cell growth and photosynthetic activity, and accumulation of reactive oxygen species (ROS) [2].

One of the most abundant primary producers in freshwater and marine systems is picocyanobacteria. Picocyanobacteria performs several additional ecosystem services; for example, picocyanobacteria *Synechococcus* has been shown to influence the cycling of phosphorus and the formation of calcium carbonate along their cell surface [3,4]. Conversely, eukaryotic primary producer, such as microalgae *Spirulina*, are critical for industrial applications and commonly used as a nutrient supplement [5].

Despite high abundances of picocyanobacteria and microalgae, we know little about the impacts of NPs on *Synechococcus* and *Spirulina*. The goal of this study is to examine the impact of NPs on the cell surface properties of *Synechococcus* and *Spirulina,* their morphology, and cell growth. We exposed cells to polystyrene (PS) NPs and then visualized and analyzed using electron and Raman microscopy. Furthermore, zeta potential measurements and potentiometric titration were performed to observe any potential impacts on the surface charge and functionalization of the NP-exposed cells. We observed agglomeration and the secretion of extracellular polymeric substances (EPS), indicating that the NP-exposed cells are under stressed conditions. Studying the impacts of NPs on cell surface properties can provide insights into the physiological and biogeochemical functions that are performed by picocyanobacteria and microalgae.

References

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