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Impacts of Polystyrene Nanoplastics on Freshwater and Marine Cyanobacterial Cell Surfaces

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More plastic debris is transported to aquatic environments with increased production and usage. Once in aquatic environments, plastic debris can undergo weathering processes to form nano-sized plastic particles, or "nanoplastics" (NPls), defined as plastic particles less than 1 μm [1]. Within aquatic environments, degradation processes and environmental factors, i.e., pH and ionic strength, determine the size, surface charge, and reactivity of NPls [2]. Thus, NPls can interact with cell surfaces, leading to adverse effects. The sorption of NPls has been reported to deform cell morphology, impair photosynthetic activity, and induce the production of reactive oxygen species (ROS) in cyanobacteria and microalgae [3,4].

Picocyanobacteria and cyanobacteria are among the most prominent primary producers in freshwater and marine environments; picocyanobacteria genus *Synechococcus* contributes to ~20% of total primary production in marine systems. The cyanobacteria genus *Spirulina* is an essential source of algal biomass for industrial and commercial applications.

Despite their significance, the physiology and cell surface properties of *Synechococcus* and *Spirulina* under NPl exposure have yet to be explored in depth. We investigated the effects of polystyrene (PS) NPls at environmentally relevant concentrations on cell growth, morphology, and surface properties of marine and freshwater strains of *Synechococcus* and *Spirulina*. PS NPls did not significantly alter cell growth, morphology, and ultrastructure despite observations of cell-NPl interactions and changes in cyanobacterial surface charges. These observations were attributed to the aggregation of NPls and secretion of extracellular polymeric substances (EPS). Studying the impacts of NPs on (pico)cyanobacterial cell surface properties can provide insights into the physiological and biogeochemical functions that *Synechococcus* and *Spirulina* contribute to aquatic environments.

References

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[3] Hazeem et al. (2020), *Marine Pollution Bulletin* 156, 111278.

[4] Zheng et al. (2023), *Science of the Total Environment* 855, 158906.