

**Title :** Comparative Analysis of Nanoplastic Sedimentation Efficiency Mediated by Cyanobacteria in Freshwater Ecosystems

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## ABSTRACT

Nanoplastic pollution poses a critical environmental challenge in freshwater ecosystems due to the persistence of these microscopic particles and their potential adverse effects on aquatic organisms and human health. Traditional remediation methods, including membrane filtration, electrostatic particle trapping, and coagulation, often incur high costs, require substantial energy consumption, and the risk of secondary contamination. Therefore, the development of sustainable and cost-effective alternatives is essential for mitigating nanoplastic pollution. Cyanobacteria offer a promising biological approach due to their ability to produce extracellular polymeric substances (EPS), which facilitate particle aggregation and sedimentation. This study investigates the sedimentation efficiency of *Synechococcus elongatus* and *Gloeocapsa* sp. in facilitating nanoplastic aggregation under freshwater conditions, with a focus on key factors influencing the process, including morphology, size, and EPS production. Nanoplastics were synthesized via emulsion polymerization and subsequently introduced into a controlled sedimentation experiment at a final concentration of 0.005 g/mL. Cyanobacterial cultures, cultivated for three weeks, were incorporated into the system, and sedimentation efficiency was assessed by monitoring absorbance at 750 nm over a six-hour period. The aggregation of nanoplastic particles was further analyzed microscopically to compare particle size distribution before and after sedimentation. The findings will underscore the potential of cyanobacteria as a sustainable and cost-effective approach for mitigating nanoplastic contamination in aquatic environments. This study provides valuable insights into the development of environmentally friendly bioremediation strategies that could serve as viable alternatives to conventional water treatment technologies.