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Influence of polyethelene microplastics on the growth, photosynthetic efficiency and oxidative stress of marine microalga *Chaetoceros calcitrans*

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Abstract

An important hassle is that most plastics can't be degraded naturally. The annual manufacture of plastics is predicted to reach 800 million metric tonnes (Mt) by 2035 and reach 1600 Mt by 2050. Polyethylene is broadly utilised around the world, and the majority of it ends up in the aquatic environment as microplastics (MPs). The influence of Polyethylene MPs (PE-MPs) on aquatic ecosystems still needs further investigation. The current study's purpose to explore the potential harmful consequences of PE-MPs on growth, chlorophyll, photosynthetic activities, total protein content, exopolysaccharides, and monosaccharides. Additionally, the enzyme activities of C. calcitrans were evaluated including superoxide dismutase (SOD), catalase (CAT) and peroxidase (POD) marine microalgae C. calcitrans. Finally, the interactions between the microalgae cells and the PE-MPs were observed by estimating zeta-potential and morphology of the algal cells using scanning electron microscope (SEM).Thereby, the biological and toxicity impacts of PE-MPs (100μ) on Chaetoceros calcitrans were examined in this work. The results revealed that PE-MPs had a concentration-dependent adverse effect on the algal growth and performance of C. calcitrans. The maximum growth inhibition rate (IR) of C. calcitrans ranged from 46.19 to 87.62 % at the end exponential growth phase under the concentration of 25–175 mgL^{-1} comparing to the control treatment, the chlorophyll content, PSII and Fv/Fm reduced by 51.3 %, 21.49 and 16.13 %, respectively. Furthermore, total protein content and the antioxidant enzymatic activities (superoxide dismutase, catalase and peroxidase) were all improved to survive the negative effects of PE-MPs. As observed by SEM, PE-MPs adsorbed and triggered a serious physical damage on the algal cell structure. These results suggest that the ecological footprint of MPs may require more attention, particularly due to the continuing breakdown of plastics in the ecosystem.

Keywords: Antioxidant, *Chaetoceros calcitrans*, chlorophyll-a – photosynthesis, growth inhibition, polyethylene microplastic

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