Phytotoxic Effects of PET Microplastics on Barley Seed Germination

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Abstract:

Environmental pollution by various forms of microplastics has emerged as one of the significant problems of recent decades. Food-packaging materials account for approximately half of global plastic waste. Accordingly, the present study aimed to investigate the phytotoxic activity of polyethylene terephthalate (PET) microplastics, which are widely used in the production of bottles for water, juice, and carbonated beverages.

The test parameter was the percentage of germination of barley seeds (*Hordium vulgare L.*) over a 24-96-hour period. Prior to incubation, the seeds were treated with suspensions of PET microplastics at concentrations of 0.1 and 1.0 g/L and across three particle-size fractions (<1 mm, 1-2 mm, and 2-3 mm).

The results demonstrated that the phytotoxicity of PET microplastics depends on both particle size and concentration. The most pronounced inhibition of seed germination was observed for the smallest particle fraction (<1 mm) at the higher concentration (1.0 g/L), which can be attributed to its larger specific surface area. In contrast, medium-sized particles (1-2 mm) induced mild growth stimulation (hormesis), potentially reflecting an adaptive physiological response of the plants. Larger PET particles (2-3 mm) exhibited no phytotoxic activity, with germination rates comparable to the control.

Overall, the phytotoxicity of PET microplastics displays a non-linear, dose- and size-dependent pattern, reflecting both the direct toxic effects of smaller particles and the adaptive responses of plants to mild stressors. These findings underscore the importance of a comprehensive evaluation of the biological effects of microplastics within ecosystems.

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