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# Combined effects of polystyrene microplastics and copper on the growth and nutritional profile of *Raphidocelis subcapitata*

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## Abstract

Currently the global concern with microplastic's pollution in freshwater systems has been increasing. These small particles (< 5 mm) have many characteristics (e.g., ubiquity, abundance) that allow them to persist several years in the environment and negatively interact with distinct organisms including humans. In fact, they can interact either isolated or combined with other chemicals compounds (e.g., metals, polycyclic aromatic hydrocarbons) acting as vectors of these contaminants into organisms' body. Whilst the impacts of microplastics' single exposure have been more documented, studies providing insights into the combination of microplastics-contaminants in freshwater systems are still scarce. Likewise, the evaluation of the combined toxicity on primary producers have been overlooked. Hence, the aim of this study was to evaluate the single impacts of polystyrene microspheres (1  $\mu\text{m}$ ) and in combination with copper on the growth and nutritional profile (i.e., fatty acids and carbohydrates abundance and composition) of the standard freshwater microalgae *Raphidocelis subcapitata*. A fixed concentration of polystyrene was defined (0.5 p mL<sup>-1</sup>), which was tested individually or in combination with four concentrations of copper (0.055 mg L<sup>-1</sup> – concentration below EC<sub>10</sub>; 0.092 mg L<sup>-1</sup> – EC<sub>10</sub>; 0.155 mg L<sup>-1</sup> – EC<sub>20</sub>; and 0.378 mg L<sup>-1</sup> – EC<sub>50</sub>). All the chosen concentrations are environmentally relevant and these EC<sub>x</sub> values were extracted from a previous study. Results pointed-out that the isolated polystyrene and when combined with copper did not significantly affect the microalgae growth. Regarding the nutritional profile, this study found evidence of impacts of PS and PS-Cu combination on the nutritional profile, namely on fatty acids and carbohydrates composition and abundance. Polystyrene combined with PS caused a decreased in the total fatty acids' abundance, while there was not a clear tendency of total carbohydrates decreasing. Moreover, there was a decreasing of MUFAs (C18:1) and Glucose+Galactose, and an increasing of SFA and Rhamnose.

**Keywords:** *Raphidocelis subcapitata*, Polystyrene, Copper, Combined toxicity.

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