Effects of polyethylene microspheres on the growth, root length and nutritional profile of the freshwater duckweed Lemna minor

Mariana O. Rodrigues[1], Nelson Abrantes[1], Fernando J M Gonçalves[1], and Ana M M Gonçalves*†[1,2]

[1]Department of Biology CESAM, University of Aveiro, Portugal – 3810-193 Aveiro, Portugal
[2]University of Coimbra, MARE – Marine and Environmental Sciences Centre / ARNET – Aquatic Research Network, Department of Life Sciences, Portugal – Calçada Martim de Freitas, 3000–456 Coimbra, Portugal

Abstract

Due to small dimensions, ubiquitous and persistent nature, microplastics (plastic particles $<$ 5 mm) represent a significant threat to ecosystems causing negative impacts on distinct species as well as on human health. Deriving from a variety of sources, microplastics can reach high densities in environment and adsorb chemicals compounds from water/sediment compartments. Nevertheless, the impacts of microplastics on freshwater organisms, especially on primary producers, have been overlooked. Hence, this study aimed to evaluate the effects of polyethylene microspheres (sized between 10-22 μm) on the freshwater macrophyte *Lemna minor* by assessing the effects on the growth, root length, and nutritional profile (i.e., fatty acids and carbohydrates composition and abundance). Results pointed-out that growth (based on fronds number and dry weight), root length and the nutritional profile were not significantly affected by polyethylene microspheres. In fact, when exposed to the highest concentration, the growth rate and yield of *L. minor* were significantly stimulated, based on frond number. Regarding the root length, it was observed an inhibition trend that does not follow a dose-response relationship. Likewise, the composition and abundance on fatty acids and carbohydrates were not significantly affected by polyethylene microspheres guaranteeing the important input of essential fatty acids (e.g., omega-6 and omega-3) and carbohydrates into higher trophic levels. Moreover, polyunsaturated fatty acids and the monosaccharide rhamnose increased their abundance over the range of polyethylene concentrations, suggesting that they were the major contributors to the resistance of *L. minor* to polyethylene exposure. Thus, polyethylene microspheres at environmentally relevant and higher concentrations do not present a hazard at the studied levels to freshwater macrophytes.

Keywords: Lemna minor, Microplastics, Fatty Acids, Carbohydrates.

*Speaker
†Corresponding author: amgoncalves@uc.pt