Physical and chemical impacts of conventional plastic versus biodegradable glitters on freshwater primary producers

Dannielle Green*[1], Bas Boots[2], Francesca De Falco[3], and Brigitta Olah-Kovacs[4]

[1]Anglia Ruskin University – Applied Ecology Research Group, Anglia Ruskin University, Cambridge, CB1 1PT, United Kingdom., United Kingdom

[2]Anglia Ruskin University – Applied Ecology Research Group, Anglia Ruskin University, Cambridge, CB1 1PT, United Kingdom., United Kingdom

[3]International Marine Litter Unit – School of Geography, Earth and Environmental Sciences, Faculty of Science and Engineering, University of Plymouth, United Kingdom

[4]Applied Ecology Research Group – Science Building, Anglia Ruskin University, Cambridge, CB1 1PT, United Kingdom., United Kingdom

Abstract

Primary microplastics, such as glitter, are being replaced with natural and/or biodegradable alternatives. When microplastics enter the environment, their physical presence and chemical leachate may alter the physiology of primary producers. Three experiments were set up to separate chemical and physical effects of different types of glitter: polyethylene terephthalate (PET), biodegradable modified regenerated cellulose (MRC) and synthetic mica, as well as a natural particle control (kaolinite) on the growth and physiology of *Lemna minor* (common duckweed) and freshwater microalga *Chlorella vulgaris*. Plants and algae were exposed to either fresh (chemical and physical effects), leachate from glitter (chemical) or aged glitter (physical). Overall, there was little impact of PET, synthetic mica or kaolinite. High concentrations of fresh MRC glitters, however, decreased root length, biomass and chlorophyll content of *L. minor* and decreased the growth of *C. vulgaris*. Some of these effects were also present when exposed to leachate from MRC glitters, but were less pronounced. Aged glitters of any type elicited almost no response in *L. minor*. Elemental analysis revealed high concentrations of metals in MRC glitter which may explain these responses. Short-term impacts of biodegradable glitters can arise due to a combination of their physical and chemical properties, but may lessen over time as their surface coating leaches. Understanding the impacts of primary microplastics labelled as biodegradable and environmentally safe is important in the context of current microplastics legislation especially regarding derogations for biodegradable microplastics.

Keywords: Microplastics, biodegradable, cellulose, PET, plants, algae

*Speaker