Multigenerational effects of polyethylene microplastics on freshwater benthic invertebrates, Chironomus tepperi

Hsuan-Cheng Lu*†[1], Shima Ziajahromi[1], Steve Melvin[1], Anupama Kumar[2], Peta Neale[1], and Frederic Leusch[1]

[1]Australian Rivers Institute, School of Environment and Science, Griffith University – 1 Parklands Dr, Southport QLD 4215, Australia

[2]Land and Water, Commonwealth Scientific and Industrial Research Organisation (CSIRO) – Gate 5, Waite Road, Urrbrae SA 5064, Australia

Abstract

Stormwater is considered a critical pathway contributing land-based microplastics to the aquatic environment. Constructed wetlands, a commonly used stormwater treatment system, provide an opportunity to study the fate and potential effects of microplastics. The average abundance of microplastics in the sediment of constructed wetlands in Australia was 1,050 particles/kg dry sediment, which is higher than 80% of reported freshwater sediment samples globally. Around 60% of microplastics reported were less than 300 μm. In addition, polyethylene and fragments were the dominant polymer type and shape identified, respectively. Consequently, it is important to understand the potential effects of microplastics on benthic organisms. Here, we investigated the effects of polyethylene microplastics (8-20 μm) in sediment on a common freshwater benthic organism, *Chironomus tepperi*, at four environmentally relevant concentrations (125, 250, 500 and 1,000 microplastics/kg sediment) over two generations. No significant differences were observed for growth (body length and body mass) across all treatments, but survival and emergence rates of first generation showed significant decreases at the highest exposure concentration compared to the control group. For the second generation, the emergence rate also significantly decreased at the highest exposure concentration while no significant differences were observed for growth and survival. To further understand the effects of microplastics, the metabolite profile of *C. tepperi* larvae of both generations was also investigated. The results of the present study will provide information about the potential effects of polyethylene microplastics on benthic organisms.

Keywords: Microplastic, Chironomus, Multigeneration, Metabolomics

*Speaker

†Corresponding author: hsuan-cheng.lu@griffithuni.edu.au