
Microplastics accumulation in an estuarine ecosystem and ecotoxicological effects of plastic leachates on a benthic copepod

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Abstract

Estuaries represent transitional zones prone to accumulating plastic litter and subject to climate change related impacts. This had two objectives: 1) to investigate the accumulation of microplastics (MPs) during a year in an urbanized location of the Río de la Plata estuary (Argentina); 2) and to analyze in a multiple stressor scenario (two salinities) the ecotoxicological effect of leachates from weathered and pristine plastics of the most common polymers observed in the environment, under two brackish water conditions in the benthic harpacticoid copepod *Nitokra spinipes*, a keystone estuarine species. In Argentina, the MPs sampling took place monthly between February 2019 and January 2020. MPs exhibited higher concentrations in February in water (110 MPs/m³) and in April in the sediment (613 MPs/m²), with predominant polymers being polyethylene (PE) and polypropylene (PP). Northeast wind direction correlated with higher accumulation of MPs in sediment and northwest winds correlated to lower MP abundance in water. Considering these findings, the effect of plastic leachates was assessed, employing environmental and pristine samples of PVC, PE and PP from two areas (North Sea, Belgium; Río de la Plata estuary, Argentina). Leachates (80 g/L, 22°C, dark, 7 days, 80 rpm) were prepared in brackish water (7 and 15 PSU), followed by an ecotoxicological assessment of copepod mortality over a 96-h exposure (ISO 14669). A 30% mortality rate from PVC leachates, 2.5% from PP, 7.5% from PE, and 5% from the control (pANOVA < 0.0592) was observed at 7 PSU. A large effect size was observed for PVC leachates (Cohen's D ~0.8). In the combined stressors scenario (15 PSU) it was observed an increased in mortality rate: 40% (weathered PVC), 22.5% (pristine PVC) and 5% (control) (pANOVA=1.29x10⁻⁵). These findings contribute to understanding the ecotoxicological effects of polymer leachates from stranded plastics in estuarine ecosystems in a multiple stressor scenario.

Keywords: microplastics distribution, leachates effects, benthic copepod

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