Combined effects of global warming and plastic leachates from conventional and bio-based polymers on a harpacticoid copepod

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Abstract

Global warming and plastic pollution are two human-induced environmental stressors of rising concern due to their potential impact on ocean health. To tackle sustainability concerns on the production of conventional petroleum-based polymers, bio-based polymers, i.e. polymers originated from natural feedstocks, are seen as a potential alternative. However, just as conventional polymers, plastic items from bio-based polymers can leach additives and other associated substances into the (marine) environment. To date, the ecotoxicological effects of leachates from bio-based polymers are still unclear, but previous reports have demonstrated that leachates from petroleum-based polymers can induce adverse effects in marine invertebrates. Also, in the environment, organisms are subjected to a myriad of environmental stressors, among which global warming, and the combination of stressors is often not considered in environmental risk assessments. To increase our understanding of the combined effects of plastic leachates from either bio-based or petroleum-based polymers and elevated temperature (global warming), in this work we used the case study of polylactic acid (PLA) and polypropylene (PP), at control (22∘C) and elevated water temperatures (25∘C). To do so, we exposed newly hatched larvae of a harpacticoid copepod *Nitokra spinipes* to plastic leachates (80 g/L) as well as selected additives of both polymers as positive controls, at each temperature. Our preliminary results indicate that after 6 days exposure, lower larval development ratio (%) was found in 60% v/v of PP leachate ($P < 0.05$, Dunnett's test) exposure than controls at 25 ∘C, but not in 60% v/v of PLA leachate exposure ($P = 0.51$, Dunnett's test). Larvae at elevated temperature (25∘C) had a higher mortality compared to control temperature (22∘C) ($P < 0.05$, ANOVA). We anticipate that our results will contribute to assessing the impacts of bio-based polymers in multiple stressor environments and the use of more realistic scenarios in environmental risk assessment.

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