
Plastic leachates stimulate antioxidant activity in red alga *Ceramium tenuicorne*

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Abstract

Adverse effects of plastic debris in the environment are of concern. While there are many studies addressing the ingestion of plastic, we know much less about the effects of plastic leachates containing additives and breakdown products of the polymers. High concentrations of these leachates have been shown to cause acute toxicity in zooplankton, but the concentration-dependent effects on plants and algae are less understood. Also, the aging of plastic and its composition of the additives are widely discussed as the key factors governing leachate toxicity but poorly studied.

We evaluated growth and antioxidant levels in red alga *Ceramium tenuicorne* exposed to the plastic leachates with the main objective to measure the effects of aging and the presence of stabilizer Irganox 1076 (additive) in the materials manufactured using the same polymer. The test leachates were prepared from the two types of custom-made polyethylene, with and without the additive. Further, each material was artificially aged via thermal oxidation resulting in the aged and non-aged test material. Thus, a 2 x 2 factorial design was applied to evaluate the *Additive* and *Aging* factors and their interaction.

The algae were exposed to the leachates for 7 days at the leachate concentrations corresponding to 1–100 g L⁻¹ in the dose-response experiment. Upon termination of the exposure, the antioxidant capacity was measured as oxygen radical absorbance capacity (ORAC), pigment concentrations (chlorophyll *a* and carotenoids), and total phenol concentration. The lowest NOEC and EC50 values were observed in the aged plastic with or without the additive, which implies that plastic debris undergoing degradation in the environment is likely to have lower toxicity than that virgin material, regardless of the additives. Evaluation of other polymers and additives is needed for a comprehensive hazard assessment of plastic debris.

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