
Effects of microplastics from cigarette filters on terrestrial and aquatic invertebrates

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Abstract

Cigarette filters (butts) are one of the most abundant form of anthropogenic litter. Once disposed into the environment, they are subjected to weathering, such as UV radiation and other. During this process nano- and microplastics are formed. The aim of this study was to investigate the effects of cellulose acetate-based microplastics, produced by grinding non-used cigarette filters, on freshwater crustacean *Daphnia magna*, mealworm larvae *Tenebrio molitor*, and terrestrial crustacean *Porcellio scaber*. In addition, microplastics from cigarette filter was also aged under UV irradiation, according to the standard ISO 4892-2:2013, which specifies test conditions for replicating the weathering effects on plastic materials by xenon arc light in an accelerated weathering chamber. Therefore, a comparison study of the effects of aged and unaged microplastics on *D. magna* was also an important aim of this work. A comprehensive characterization of the prepared microplastic was performed by TG/DTA, FTIR analysis and scanning electron microscopy, which revealed irregularly shaped particles (< 250 µm). The results showed that a 7-day exposure to microplastics from cigarette filters at concentrations of 0.06% and 0.5% w/w per dry soil slightly altered the immune processes of *P. scaber*, as evidenced by a decreased total haemocyte count. In contrast, a 14-day exposure caused no changes in the measured immune parameters in the haemolymph. In mealworm larvae, energy related traits, e.g. electron transport system (ETS) activity and lipid content, were measured. We observed an enhanced ETS activity at 0.5% w/w and increased lipid content after 14 days of exposure to 0.5% and 1.5% w/w. On contrary, no effects of exposure to unaged and UV-aged microplastics on *D. magna* were observed. Overall, research findings suggest that cellulose acetate-based microplastics from cigarette filters may induce an altered physiological profile in terrestrial invertebrates, but no severe adverse effects were observed under conditions tested.

Keywords: microplastics, cigarette filters, UV, aged, *Daphnia magna*, *Tenebrio molitor*, *Porcellio scaber*

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