

Assessment of urban environment aged microplastics as potential carriers of micropollutants to soil-plant systems

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Microplastics have been identified as emerging pollutants in soil-plant systems, even if there are still research gaps regarding the behavior and the degree of the effects of microplastics on these systems [1]. The use of treated wastewater and biosolids in agriculture is one of the identified sources of microplastics and other emerging pollutants into soil-plant systems since many of these substances are not efficiently removed during wastewater treatment [2].

Thus, the main goal of this study was to evaluate the potential of microplastics aged by urban environment stressors, such as those of disinfection treatments or exposure to weathering, as carriers of organic micropollutants to soil-plant systems. For that, microplastic particles of three polymers (LDPE – low-density polyethylene, PET – poly(ethylene terephthalate), and uPVC – unplasticized poly(vinyl chloride)) were previously aged by ozone exposure or by rooftop weathering. Then, sorption experiments were carried out to assess the sorption of ten organic micropollutants (OMPs), including pesticides and pharmaceutical substances, on microplastics (virgin or aged). Finally, phytotoxicity tests with the aged and OMP-sorbed microplastics were performed for two species of plants: *Lepidium sativum* and *Sinapis alba*.

The results show increased sorption of several of the selected OMPs on the microplastic particles after the aging treatments, although different affinities were observed between each OMP and polymer. The effectiveness of the aging treatment was previously assessed by characterizing the microplastic particles (i.e., by ATR-FTIR, SEM and XRD) before and after aging [3], allowing to link the modifications between virgin and aged microplastics to the increased sorption capacity of certain OMPs. The phytotoxicity test results showed normal early growth or a very low decrease in the early growth of the plant species selected under the conditions tested. Nevertheless, considering that the hypothesis that microplastics can sorb and, therefore, transport OMPs under certain conditions to ecosystems was confirmed, and that aging can increase their sorption capacities, this study is a further evidence of the pressing need for more research on the toxicity of microplastics with sorbed pollutants on soil-plant systems.

This work was financially supported by: LA/P/0045/2020 (ALiCE), UIDB/50020/2020 and UIDP/50020/2020 (LSRE-LCM), funded by national funds through FCT/MCTES (PIDDAC). M.N.M. acknowledges the PhD research grant from Fundação para a Ciência e a Tecnologia (FCT) (Ref. PD/BD/137730/2018, extended by COVID/BD/152633/2022), funded by national funds and by the European Union (EU) through the European Social Fund (ESF).

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