EVALUATION OF THE ROLE OF PLASTIC AGING ON THE SORPTION OF PESTICIDES AND PHARMACEUTICAL SUBSTANCES ON MICROPLASTICS

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Microplastics' sorption capability has been studied over the last decade to better understand the potential impacts that they have on the ecosystems and human health. However, the role of plastic aging, in which the polymer's physical and chemical properties are changed due to exposure to environmental agents, such as weathering, has been overlooked. Consequently, there is a need to explore the role of the aging processes in the interaction of microplastics with other pollutants, and the potential risk of an enhanced capacity of microplastics carrying co-occurring pollutants between environmental compartments and ecosystems. Thus, the main goal of this study was to evaluate the changes in the sorption capacity after aging microplastics of LDPE – low-density polyethylene, PET – poly(ethylene terephthalate), and uPVC – unplasticized poly(vinyl chloride). Through sorption experiments, virgin and aged (by ozone exposure or 3 months of rooftop weathering) microplastic particles of the three polymers were exposed to ten organic contaminants (pesticides or pharmaceutical substances) at trace concentrations, including both priority substances and contaminants of emerging concern. The results show increased sorption of these contaminants on the microplastic particles, which is dependent on the affinity between each polymer and organic contaminant, and the effectiveness of the aging treatment. A better understanding of the interaction between these different pollutants was reached due to the analysis of the sorption experiments results when accounting for modifications of the chemical structure, surface morphology and/or crystallinity of the microplastic particles identified after the aging processes. This study supports the hypothesis that microplastics can be transport vectors for other pollutants and demonstrates the major role of the aging degree in the sorption process. Thus, it provides further evidence of the pressing need to study microplastics in more realistic conditions, in which they undergo aging and interact with other pollutants.

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