Microplastics occurrence in an urban space - Coimbra city case-study

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The progressive increase of population living in cities led to the aggravation of the pollution problem worldwide, especially in urban environments. Air, water and soil are compartments affected by this reality, and the pollution leads to human health problems. There are many different point and non-point sources of emerging pollutants such as microplastics, which are transported diffusely through wind and rain. Therefore, it is very complex to quantify, control and treat these pollutants, designated current problematic issues by the European Commission. Green areas are pointed out by experts as natural filters for contaminants in cities, through their capacity of retention by leaves and soil.

This study investigates the contamination of microplastics in urban green areas soils, as well as the possible sources of microplastics, with a case-study in Coimbra (Portugal). Nine samples of fifty grams of soil were taken: three from a mixed broad-leaved with coniferous forest; three from a green park; three from a natural grassland. Six samples of three litres of water were taken from: rainwater (wet and dry deposition); runoff; freshwater; stream near the mixed forest; stream near the green park; stream near the natural grassland. All the samples were analysed in the laboratory through the extraction of microplastics using the flotation and filtration methods, and the visualization and identification of the particles with a microscope.

Microplastic particles were found in all samples. The number of microplastics found in soil samples varies between 2200 p kg⁻¹ and 190400 p kg⁻¹, both values obtained in a green urban park. Different levels of microplastics were found in the soil of the three sampled spaces with just a few meters of distance. Most of the particles (80%-98%) have less than half a millimetre. The water samples contained a lower number of microplastic particles. The values ranged from 27 p l⁻¹ in a peak flow stream near the natural grassland and 7 p l⁻¹ in freshwater from the tap. In rainwater were found 15 p l⁻¹ and in runoff 17 p l⁻¹ particles. Almost all microplastics particles (97%-100%) from water have less than half a millimetre.

Characteristics such as leaf area index, road proximity and intense precipitation episodes could influence the quantity of microplastics in the soil of green areas and in the streams and runoff. In order to control the entry and the concentration of microplastics in the environment and treat
polluted areas, especially in cities, it is essential to quantify the microplastics particles considering the sources, pathways and the local characteristics of vegetation and soils.