

Development of novel analytical methods to trace small micron and nanoplastics in food matrices

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In the last decades, our life style significantly changed, for instance in terms of consumption of convenient food or usage of single-use items. As a direct consequence, the production of plastics is globally increasing, as well as their release into the environment, threatening wildlife and human health. Most of the produced plastics are used for packaging items, from cosmetic to food applications. Up to now, the most common plastics used for packaging have been petroleum-derived, such as polyethylene (PE), polystyrene (PS), polyethylene terephthalate (PET), polyvinylchloride (PVC), polypropylene (PP) and polyamide (PA), because they have some interesting properties such as tensile and tear strength, or barrier activity against oxygen and carbon dioxide, and the cost-effectiveness [1].

However, a part from macroplastics, we are facing with the serious problem of microplastics (MPs) and nanoplastics (NPs), mainly originating by physico-chemical transformation processes, such as aging, degradation and fragmentation. Because of the ease in their detection, several studies have been conducted on larger MPs in terms of occurrence, distribution, quantification, and toxicological effects on humans identifying food as their main intake source [2]. Nowadays, research interest is going towards MPs with a diameter smaller 1 μm , called nanoplastics (NPs) that could be found in food matrices and environmental samples, by means of specific measurement techniques. Therefore, the aim of this work is to develop innovative methods to apply in the individuation, quantification and characterization of small micron and nanoplastics in food matrices, such as drinking water and milk, in the contest of PlasticTrace European project [3].

For this purpose, in this work, asymmetric flow field-flow fractionation (AF4) has been coupled with multi-angle dynamic light scattering (MADLS) and Raman spectroscopy. In particular, samples containing NPs have been separated by hydrodynamic diameter with AF4, then analyzed by MADLS to characterize their size and size distribution. Finally, the polymer type of the NPs has been identified by Raman microspectroscopy. As a side supporting technique, atomic force microscopy (AFM) has been employed to investigate the shape and the morphology of the NPs.

Keywords: nanoplastics, food matrices, field-flow fractionation, raman spectroscopy

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