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SEM and Raman analysis in a single chamber for the analysis of the environmental contamination by nano- and microplastics

Microplastics (MPs) are a form of marine debris smaller than 5 mm in size. They are usually described based on criteria such as colour, shape, polymer type and size [1]. Originating from human activities, they became ubiquitous in worldwide seawaters, and especially in the coastal zones where they contaminate living organisms. As filter-feeding organisms, mussels accumulate a wide range of contaminants from their environment, including MPs with characteristics consistent with those of their surrounding environmental media [2-5]. Since mussels are consumed entirely, without gut removal, they became one of important vectors to transfer MPs into human food chain [6]. In a context of food security, it is thus important to monitor the contamination of mussels and describe the shape, nature and size of MPl. Unfortunately, the size distribution is usually presented between 5 µm and 5 mm whereas smaller plastics are also expected. This is related to the limit of detection of microscopic methods. In these conditions, a fraction of MPs is never described. We used the recent developments of methods from nanotechnology to solve this technical bias. We used Raman spectroscopy coupled to scanning electron microscopy in a single chamber. Model microplastics and nanoplastics of polyethylene and polystyrene were used to model small marine debris. By adapting the protocol and choosing the right parameters, we succeeded in recording Raman spectra of nano- and microplastics without destroying them. These measurements were done in the project Moustic funded by Anses (French Agency for Food, Environmental and Occupational Health & Safety).

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