QUANTIFICATION OF MICROPLASTICS IN AIRBORNE PARTICULATE - A COMMON SAMPLE PREP PROTOCOL SUITABLE FOR MASS AND MORPHOLOGY IDENTIFICATION

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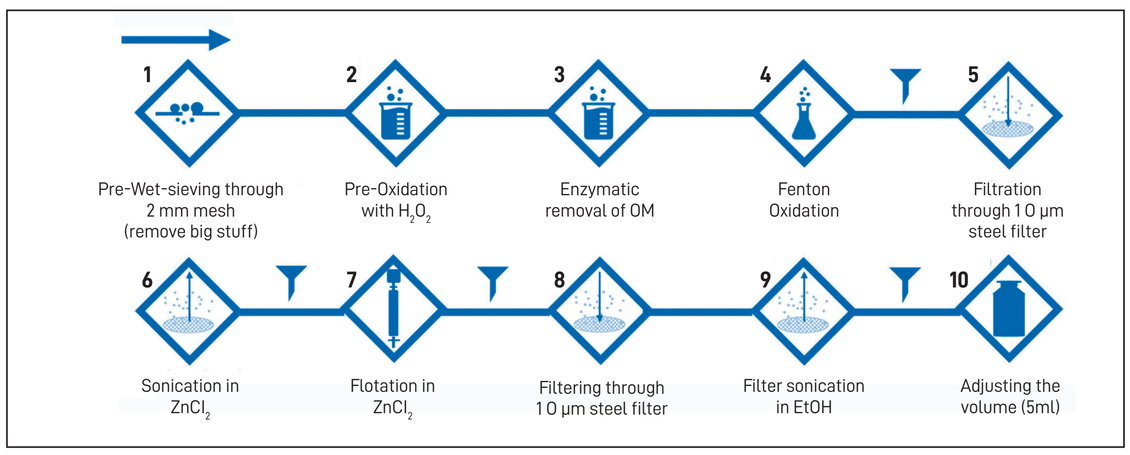
INTRODUCTION

The increasing use of synthetic materials has made plastic pollution an important environmental problem related to human health and ecosystems. A major concern is the possibility of micro plastic particles (MPs) being dispersed into the air as particles and inhaled by humans, which can harm respiration. In this work is proposed a mass quantification through pyrolysis GC/MS preceded by a dedicated sample preparation. Sample prep described in this work does not involve, as final step, filtration which let to analyze an aliquot of microplastics with a spectroscopy technique like LDIR (laser direct infrared).

SAMPLE PREPARATION PROTOCOL

The sample preparation is a key aspect of MPs and, in order to couple mass and morphology techniques, a common protocol has been adapted from existing literature. A general-purpose protocol is shown below:



In our case all oxidations were skipped since sample is pretty clean and the extraction protocol started at step 5. The key point is related to step 10 since the end point is a suspension of MPs in ethanol which can be addressed both to LDIR or pyrolysis GC/MS.

Agilent 8700 Laser Direct Infrared Imaging system for fast and automated analysis of microplastics in environmental samples.

Pyrolysis-GC/MS FrontierLab-Agilent solution for microplastics analysis for identification and quantification (mass concentration) of microplastics in various matrices.

New software F-Search MPs 2.0 FrontierLab for microplastics analysis. It consists of a sophisticated search program with mass spectral libraries of pyrolyzates. The software is used with the data obtained by pyrolysis-gas chromatography/mass spectrometry.

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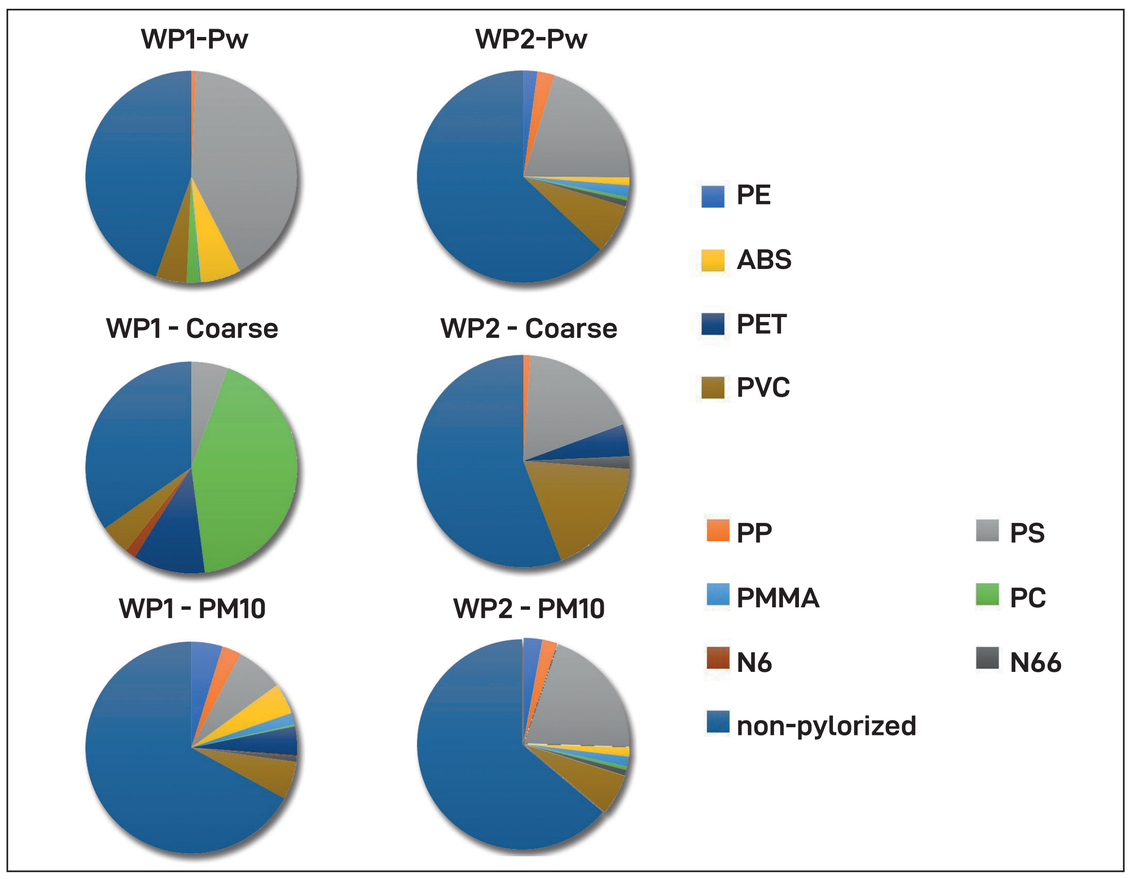
RESULTS AND DISCUSSION

Samples were divided into three subsamples: powder, PM10 and coarse filter.

Polymers	WP1-Pw	WP1-PM10	WP1- Coarse	WP1-Pw	WP2-PM10	WP2- Coarse
	µg	µg	µg	µg	µg	µg
PE	-	33.2	-	20.9	34.3	-
PP	1.1	20.4	-	25.8	27.3	1.3
PS	68.0	50.4	9.4	199	239	21.7
ABS	10.1	32.8	-	11.6	16.4	-
PMMA	0.4	12.5	-	17.5	18.1	0.1
PC	3.1	1.8	70.2	4.8	5.7	-
PET	-	30.6	18.3	-	-	5.9
N6	-	1.3	2.7	-	-	-
N66	-	5.7	-	9.1	10.8	2.3
PVC	7.7	40.1	7.7	73.4	74.0	21.4
NP fraction	72.6	465	57.7	616	752	66.4

Table 1: Quantitative analysis results obtained on the powders and the filters by Py-GC/MS analysis. Coarse: PM1-10; Pw: powder. NP: non pyrolizer sample portion.



CONCLUSIONS

The results obtained by Py-GC/MS analysis on the indoor particulate recovered from two filters at different sizes fractions were significatively different, both in terms of amount of NP residues and of polymer distributions, thus suggesting a size distribution of the typologies of materials/polymers.

The proposed method was found to be efficient in detecting both microplastics and polymer additives in airborne particulate matter. Sample preparation protocol can be used not just for detecting airborne particles but also microplastic in general coming also from other matrixes. Spectroscopy data are under development, but sample preparation is perfectly suitable for both techniques.

REFERENCES

1 - Pomata, Donatella and La Nasa, Jacopo and Biale, Greta and Ceccarini, Alessio and Di Filippo, Patrizia and Riccardi, Carmela and Buiarelli, Francesca and Modugno, Francesca and Simonetti, Giulia, Plastic Breaths: Quantification of Microplastics and Polymer Additives in Airborne Particulate. Available at SSRN: https://ssrn.com/abstract=4421205 or http://dx.doi.org/10.2139/ssrn.4421205.

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