Microplastics in Rome's rainwater

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Introduction

One of the most insidious aspects of plastic pollution is their presence as microplastics in all the environmental compartments. The scientifical investigation of this problem has started recently and there aren't solid data on microplastics abundance in the environment, but it's reported the presence of microplastics in the human body [1]. Wind can transport microplastics for long distances [2] and the microplastics in the air can be breathed and get stuck in the lungs [3], but there aren't reliable data about the microplastics' effects on human body. Rain can drag microplastics from the air to the soil, so their abundance in the rain may be correlated with the microplastic pollution of the air [4].

[1] Jenner, L. C., Detection of microplastics in human lung tissue using μFTIR spectroscopy. Science of The Total Environment, (2022) 831

[2] Allen, S., Atmospheric transport and deposition of microplastics in a remote mountain catchment. Nature Geoscience, (2019), 12(5), 339-344

[3] Amato-Lourenço L.F., Presence of airborne microplastics in human lung tissue J. Hazard. Mater., (2021), 416, 126124

[4] Zhen Y. Atmospheric microplastics at a southern China metropolis: Occurrence, deposition flux, exposure risk and washout effect of rainfall, Sci. Total Environ. (2023), 869, 161839

Microplastics analysis

In this work we collected and examined samples of the rain that fell in Rome from 1st December 2020 to 31st July 2021. The collection of the rainwater was made for each weather event (50) with a Pyrex beaker (0,15 m Ø) located on the roof of the "Cannizzaro", a building of the chemistry department of "La Sapienza" University of Rome, Italy (GPS coordinates: 41° 54' 07" N, 12° 30' 50" E, 69.5 m a.s.l.). Also, we took data from a weather monitoring station near the sampling site. The samples were filtered by pure fiberglass filters (Merck Millipore, 25 mm Ø, pore size 2,7 μm) and the filters were analyzed with a microscope (Motic BA200) with a camera (OMAX A3530U, 3.2 Megapixel). Because microplastics are ubiquitous we used a quality protocol to reduce and determinate the contaminations: all analysis were made under a very clean chemical hood and we analyzed two milliQ water samples as blanks to determinate the contamination.

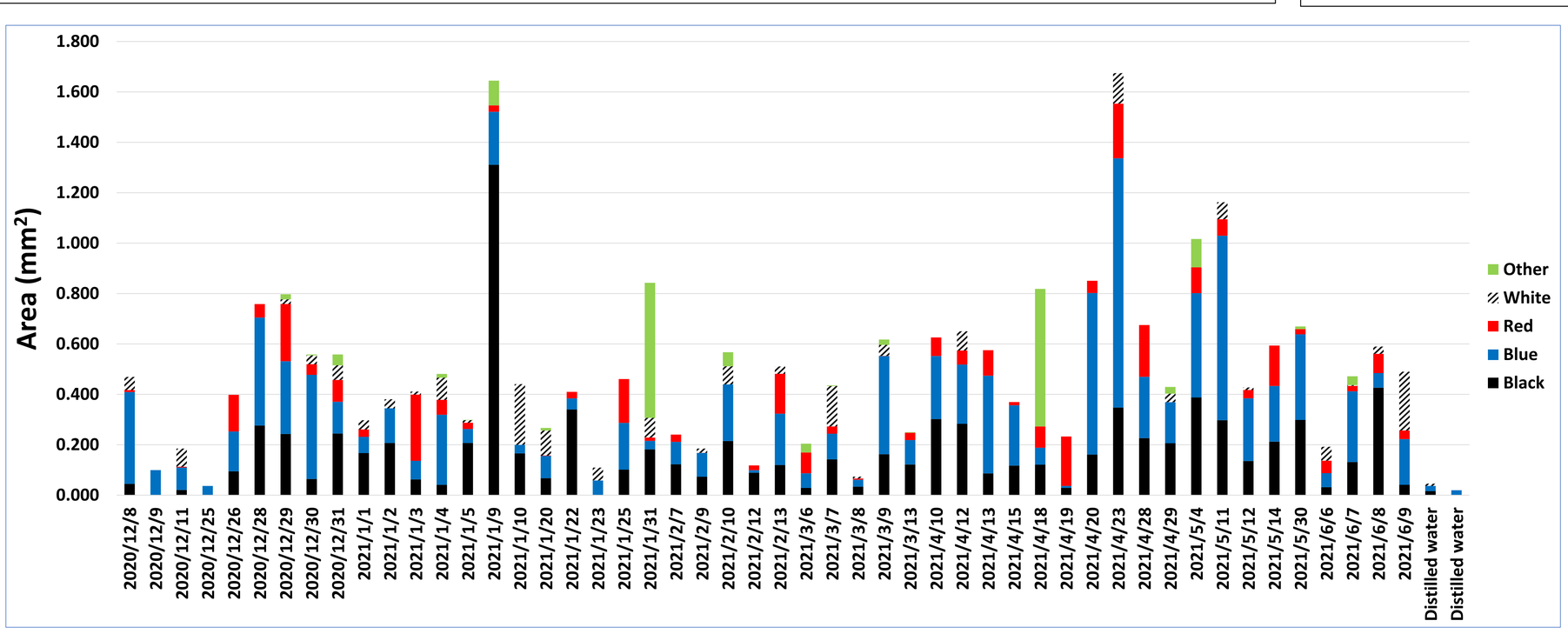

Chart 1: Total area occupied by microplastics and their color on every filter compared to the two blanks

Figure 1: A microplasic fiber found in a rain sample

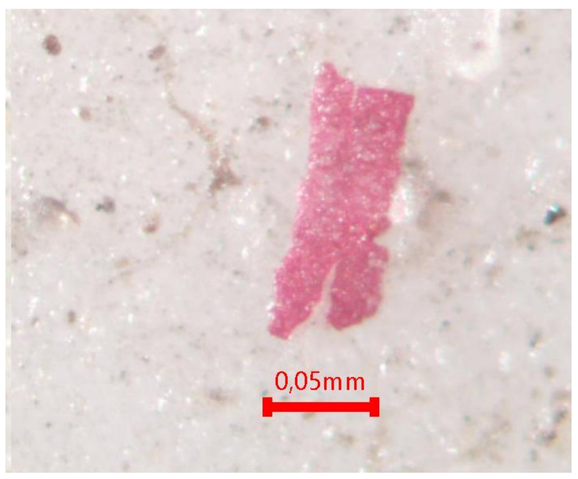

Fig. 2: microplastic fragment found in the rain

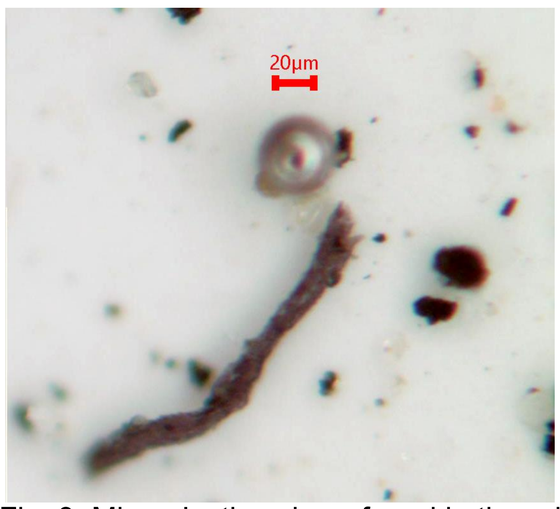

Fig. 3: Microplastic sphere found in the rain

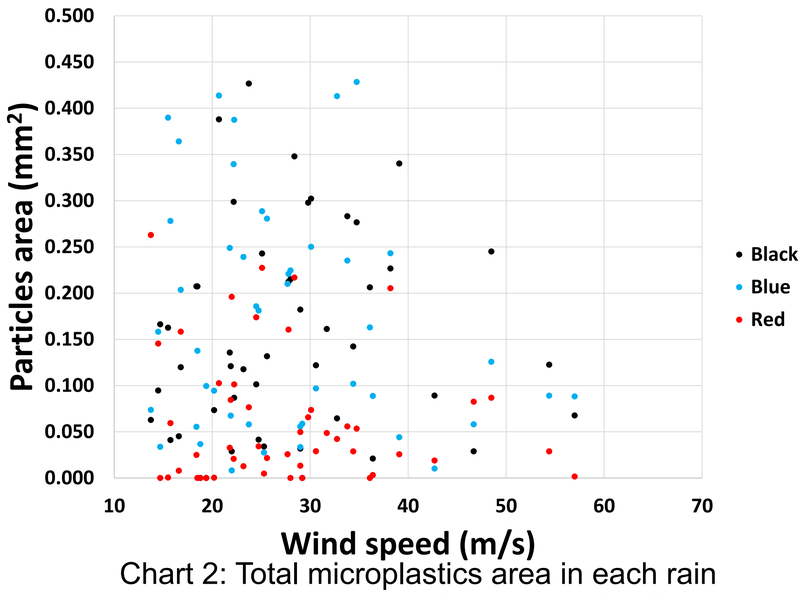

Chart 2: Total microplastics area in each rain versus wind speed during the rainfall

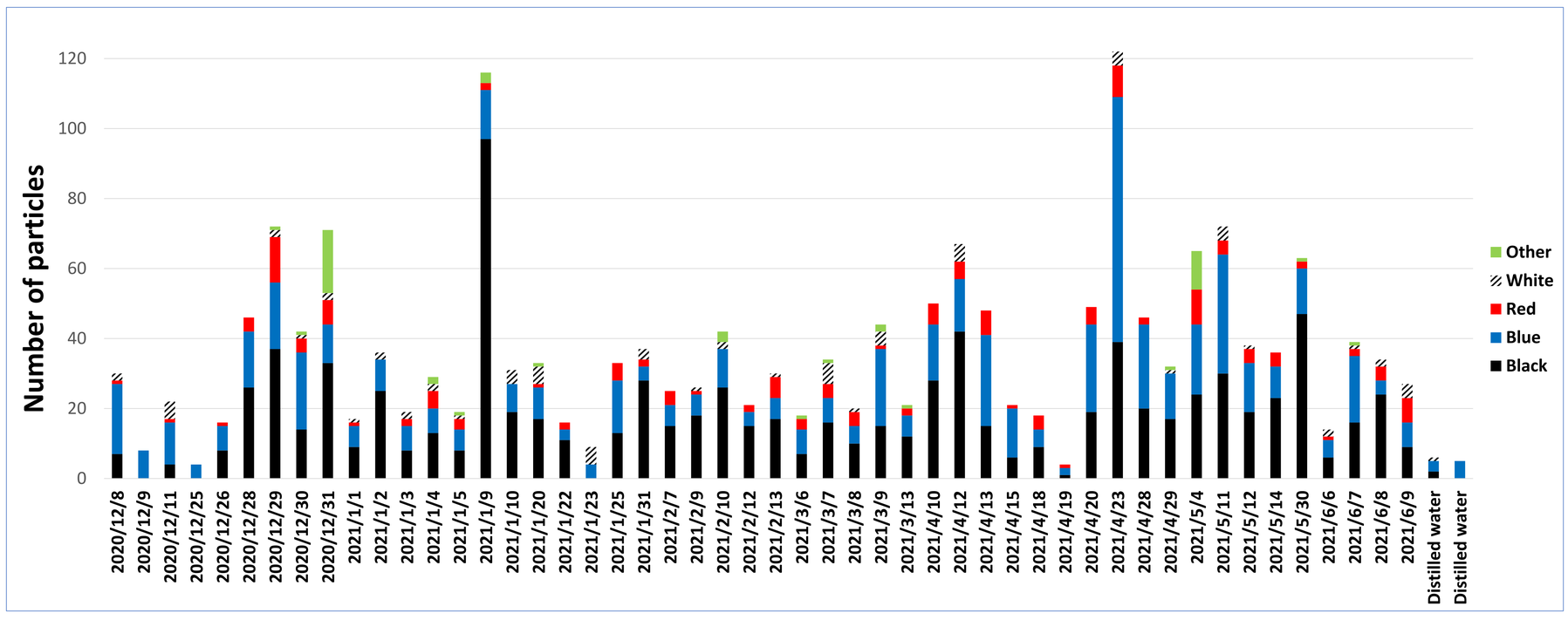

Chart 3: Number of microplastics and their color found in every sampled rain and two blanks

Results

The observation of the filters with the microscope shown many particles recognized as microplastics for their shape [fig. 1] [fig.3] and color [fig. 2]. We collected data about these particles: dimensions, shape and color. In all filters we found fibers, fragments and spheres in the following total quantities: 1833, 41 and 19 respectively. Due to the different dimensions of microplastics, we reported the results as total area occupied by them on the filter [Chart 1], then as number of microplastics on filter [Chart 3]. The results shown a variable amount of microplastics in the rains and a low level of contamination in the blanks. The majority of microplastics found on the filters is black, blue or red, but there are also white, green, gray and yellow particles. We correlated the total area occupied by the microplastics on the filters with the speed of the wind during the rainfall [Chart 2]. Results shown that to a slow wind , a variable amount of microplastics on the filters corresponds, while for a speedy wind we found only a low quantity of microplastics on filters.

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