ARE CLIMATE CHANGES TO BE ATTRIBUTED ONLY TO GREENHOUSE GASES? A POSSIBLE ROLE OF PLASTICS

Giovanni Visco, Emanuele Dell'Aglio, Cristina Giannattasio and Maria Pia Sammartino
Department of Chemistry, Sapienza University of Rome

SAPIENZA UNIVERSITÀ DI ROMA
Dipartimento di Chimica

INTRODUCTION

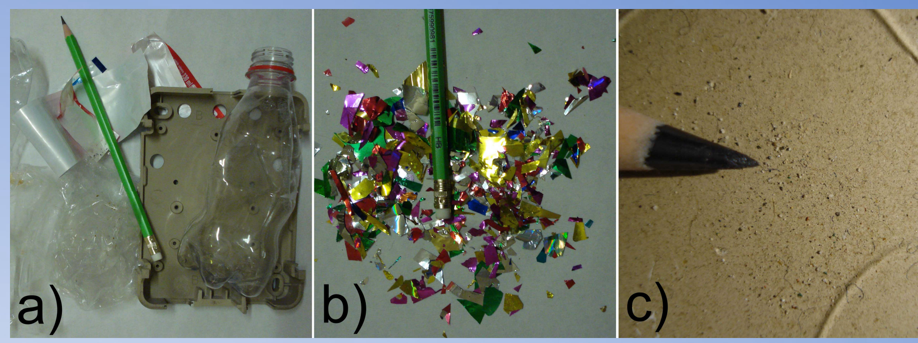

Fig. 1 a) Macroplastics, b) Mesoplastics, c) Microplastics.

Lot of researches deal with the problem of greenhouse gases, first of all CO_2, because they are recognized as main responsible of climate changes. A scarce attention is instead posed on pollution, in general and by plastic in particular, that can directly or indirectly affects climate.
Plastics are currently ubiquitous as, directly or indirectly, used in all industrial sectors. The effect of their disposal has been recognized as devastating both at an aesthetic level and, above all, for the effects on the aquatic environment that touches the man through the food chain. The severity of the problem increases over time due to their accumulation, bound to the recalcitrance of the plastics, and to the reduction of their dimensions (**fig. 1**) that entails their entry into the bloodstream and, in turn, in all the organs. As a fact we found microplastics (at least two dimension < 1 mm) in commercial salts; this means that we eat them with all cooked foods. It is also well known that the sea accumulates heat through solar irradiation during the day and releases it during the night; so, it is obvious that high amount of plastic on the surface of sea alters the marine environment modifying, both in intensity and spectrum, the solar light crossing the water layer.

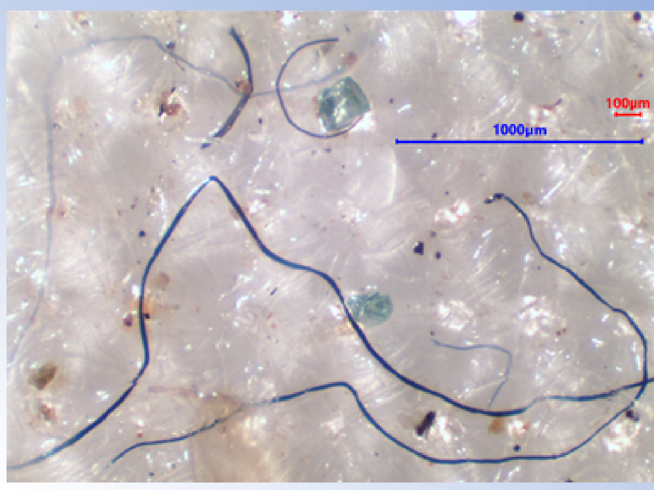

Fig. 2 Microplastics from salt's filtration on cellulose filter.

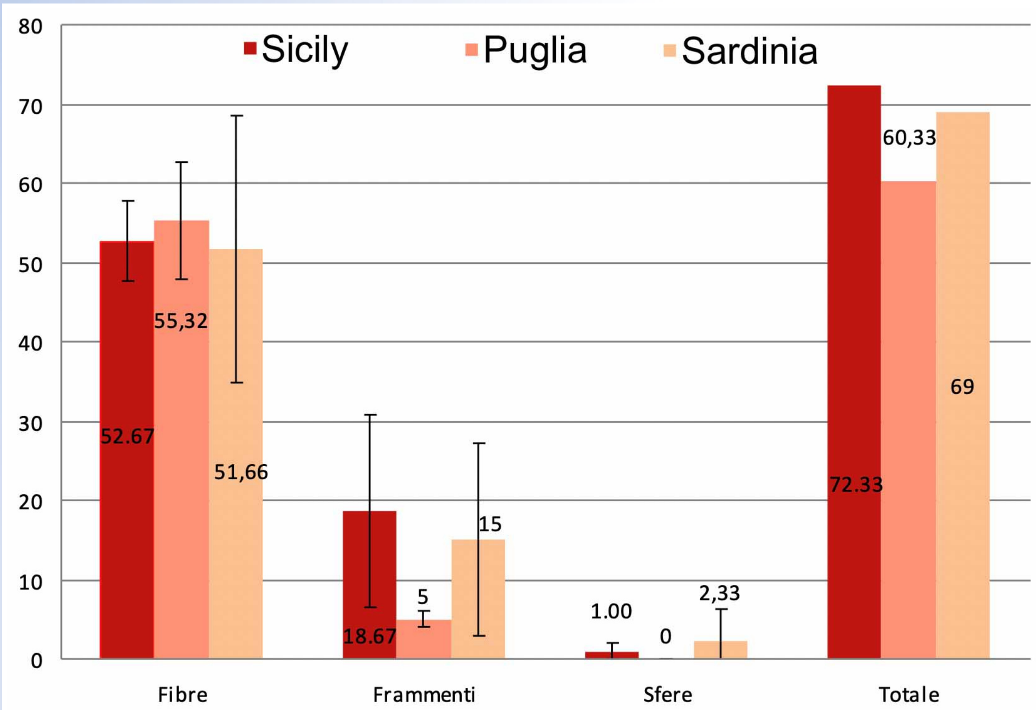

Fig. 3 Quantification of the different classes of microplastics found in salts from different salt flats.

MATERIAL AND METHODS

We examined samples coming from the filtration of 6 saline salt solutions (different brands of commercial course salt from 3 different Italian salina), the microplastics were quantified divided in three classes: fibers, fragments and spheres and measured using images from a microscope (**fig. 2**). They were also characterized by micro Raman, micro FTIR, UV-Vis spectrophotometer and SEM/EDS.
The transmitted radiation, along the thickness of 30 plastic samples (manly wraps of sweets and snacks), was evaluated with a portable spectrophotometer using an optical fiber. Each sample, placed on the optical fiber, was irradiated by Xenon lamp.

Tab. 1 Dimension ranges of microplastic found in salts.

	Width (μm)	Length (μm)	Diameter (μm)
fibers	3-25 [12±5]	157-4768 [1376±1230]	
fragments	8-91 [62±28]	27-132 [81±28]	
Spheres			14-34 [27±8]

RESULTS AND DISCUSSION

Figure 3 shows the quantification of the different classes of microplastics found on two filters in series (cotton fabric and cellulose paper 20-30 μm) while **table 1** summarizes the relative dimensions (average ±SD in square brackets). the number of particles may seem low but, being referred to 36 g of salt, corresponds to a considerable content per kg. All the particles fall within the range of the microplastics and from their characterization they results constituted by Polyethylene, Polypropylene, Polystyrene and Nylon. Some synthetic cellulose fibers and glass spheres were also found.

Preliminary results obtained from the tests performed to evaluate the spectra changes of the light crossing plastic sheets demonstrated that very saturated in colour samples completely attenuated the light.

Spectra in **figure 4,** referring to the more transparent samples, show the expected attenuation of the light as a function of the colour saturation: for the red sample (21A) spectra looks as an almost flat line close to the zero intensity while the less attenuated spectrum corresponds to the transparent sample (25C). More, the stronger attenuation on charge of the transparent plastic falls in the zone of interest for the photosynthetic processes. Lastly, in some cases the band's maximum shift toward higher λ, I.e. lower Energy.

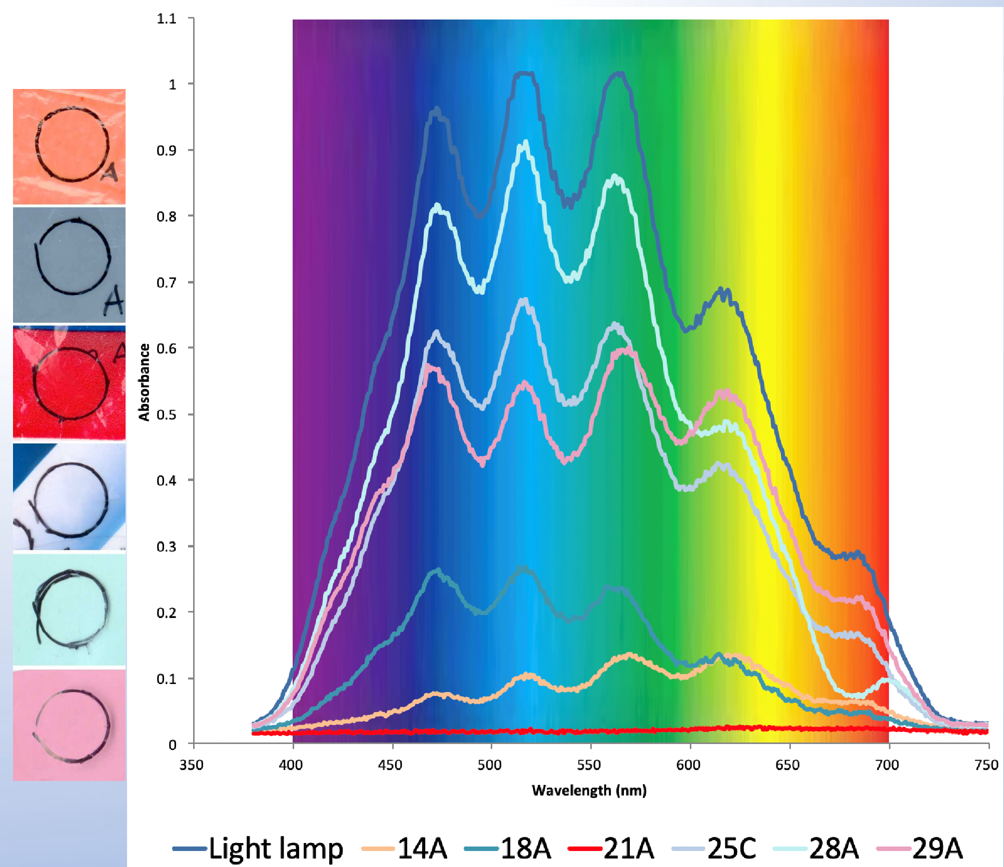

Fig. 4 Attenuation of light crossing plastics.

CONCLUSION

A noticeable content of microplastics remain entrapped in sea salt during its production; their chemical composition is congruent with the plastic more commonly used (Polyethylene, Polypropylene, Polystyrene , Nylon). Their content in salt reflects a primary use of abrasives in cosmetics (spheres), a loss of fibers from textiles (fibers), the degradation of everyday objects, especially disposable bottles and crockery.

Even if the research needs a deepening, preliminary results demonstrated a noticeable alteration of the light after crossing plastic, this can means that pollution from plastic play a role in climate changes?

FIRST SCIENTIFIC SYMPOSIUM
Health and Climate Change
Istituto Superiore di Sanità
Italian National Institute of Health
Green event
Rome | December 3-5 | 2018