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Monitoring of microfiber pollutants in karst environments

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Recent studies highlighted a preoccupant pollutant which impact natural environments: the microfibres. The term “anthropogenic microfibres” (MFs) includes fibres <5 mm in length of any composition (natural, regenerated and synthetic) derived from larger primary textiles manufactured for human use. MFs have been detected in different environments, as well as in human and animal organs, and adverse effects on animal health have been studied. Not-synthetic MFs have been often considered microplastics because of their colours, and because a lot of them are extruded and processed industrially. However, natural and regenerated fibres are a source of carbon for organisms, and are generally considered biodegradable. However, despite the general consensus on the reduced dangerousness of the not-synthetic fibres in the environment, little is known about their degradation in ecosystems. Their potential faster degradation could release toxic compounds into the environment, such as resins, dyes, and flame retardants. In addition, natural and regenerated textiles release more fibres than synthetic ones during laundering. All these factors may explain a long-term accumulation of MFs in the environment over time.

The Classical Karst Region represents important habitats characterized by the presence of dissolution feature in carbonate rock such as caves and sinkholes, which connect surface and subterranean environments. The Classical Karst waters played an important role for the development of this region: thanks to the high water quality, this area has been heavily exploited and was strongly altered by human activities, which irreversibly modified the hydrology of the system.

In this preliminary study we collected and investigated several water and submerged sediment samples in different caves and springs of the Classical Karst Region. MFs from 5 to 0.1 mm were counted and characterized by size, color and shape via visual identification under a microscope, with and without UV light. Spectroscopic analyses were carried out on 10% particles.

MFs were found in all samples, highlighting MF pollution in surface and subterranean habitats in the karst system. The 81% in water and 74% in submerged sediments were natural and regenerated fibres, while only 13% and 10% respectively were synthetics. The size distribution of collected MFs indicated that big MFs (1-5 mm) are less abundant (<22%). More than 80% of fibres were fluorescent under UV light. Of the fluorescent MFs, 91% were transparent; non-fluorescent MFs were mainly black and blue. Of the synthetic fibres, samples contained especially polyesters and copolymers.

Our results improve knowledge on micro pollutants in aquatic and karst environments, laying the foundations for future research. MF pollution monitoring in karst areas must become a priority for species protection, habitat conservation, and waters management, improving analyses on a larger number of aquatic environments, taking into account the ecological connections between surface and subterranean habitats.