Mosses as biomonitors of airborne dusts and their potential application for monitoring cosmic dusts

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The use of mosses represents a cost-effective and eco-friendly approach to evaluate qualitatively and quantitatively the atmospheric particles, as alternative or complementary method to the conventional monitoring systems. Mosses are in fact well-known plants able to absorb and entrap airborne particles of different nature (Di Palma et al., 2017). The usefulness of mosses as biomonitors of airborne dusts is given by a huge literature produced in the last decades and some EU funded Projects such as the UNECE ICP Vegetation Programme Biomonitoring Network (Harmens et al., 2015) based on the collection of native species, and the EUFP7 project "MOSSclone" (Capozzi et al., 2016; Di Palma et al., 2016) aimed at developing a standardized protocol for the moss bag technique consisting in the exposure of mosses inside nylon bags in sites chosen for monitoring surveys (Ares et al., 2012).
It is well-known that some particular atmospheric particles defined as cosmic dusts can be considered as "historical archives" of the universe, as they can provide information on the origin and evolution of the universe and its components. However, the study of extra-terrestrial dusts can represent a hard challenge, particularly for those consisting of nanosized particles. Moreover, the cosmic dusts in their original form (i.e. before modification by the contact with our atmosphere) have very low concentrations in the environment, as they mostly resemble the dusts commonly found in the air, especially in terms of chemical composition and physical properties.
Recently, the occurrence of extra-terrestrial materials was investigated in mosses and lichens collected in remote areas of Antarctica (Mróz et al., 2018), thus opening new frontiers on the use of mosses as biomonitors and on the monitoring of cosmic dusts.
At the present, our research activities are aimed to the monitoring of airborne dusts in the environment by using mosses and on the characterization of the particles entrapped by the biomonitors, with a particular attention to those containing ^{137}Cs. Among the techniques we employ, the Electron Probe Micro Analyzer (EPMA) is the most useful to characterize the airborne particles entrapped by the biomonitors in terms of number, shape, size and chemical composition, and therefore it might be applicable in the perspective of investigations on cosmic dust biomonitoring.

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