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Microplastic pollution in soil: a case-study from the Raffaele Viviani public park in Naples, Italy

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Microplastic pollution is becoming a growing environmental concern globally. Over the past decades, the ubiquity and persistence of microplastics have raised crucial questions about their presence, distribution, and impacts in soils. Environmental factors such as soil chemical composition, moisture, temperature variations, and biological activities dynamically contribute to the fate and transport of these particles. Research on the presence of microplastics in soil is still in a developmental stage, and standardized methods for identification are lacking. In this study, we introduce a method for identifying microplastics, specifically in an area of the Raffaele Viviani public park in Naples (Italy), that has a history of various waste disposals in the last decades. The study provides detailed a description of sampling procedures, sample preparation, and analysis techniques. A mineralogical analysis was conducted to characterize the soils and understand if there were deposits of foreign material, through X-ray diffractometry. To isolate microplastics, a method utilizing a 1.5% sodium dodecyl sulphate surfactant for dispersion, and density separation with a saturated NaCl solution for the extraction of microplastics. Microplastics identification was achieved using a portable Raman spectrometer, and spectrum interpretation was conducted using the open-source program and database OpenSpecy. The use of a database was fundamental for identification, accomplished by comparing spectra from the database with the spectra measured in the samples. Results highlighted the presence of various plastic types, some showing signs of degradation under the microscope, indicating potential interactions with the surrounding environment. Mineralogical analyses confirmed the presence of mineral phases typical of the local geological formation, the ca. 15 ka volcanoclastic Neapolitan Yellow Tuff, although the finest fraction was compromised during sample preparation. The study implies that an initiative to establish a Food Forest in the Raffaele Viviani public park raises concerns about potential plant exposure to contaminants represented by microplastics and their potentially harmful heavy metals. In conclusion, this study is meant as a starting point, emphasizing the need for further research to fully comprehend the extent and implications of microplastic degradation processes. It proposes awareness and collective commitment as crucial keys for addressing environmental pollution and ensuring a sustainable future.

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