Assessment methodologies to measure microplastics

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Abstract

The impacts of Microplastic Pollution (MPs) on human health, the environment, economy, and society have undergone prior studies; however, there persists a notable gap in understanding crucial aspects necessitating action against marine pollution (Chatziparaskeva et al., 2022). An imperative focal area lies in the Mediterranean coastline, where the accumulation of MPs raises significant concerns. With around 480 million inhabitants dwelling in the Mediterranean basin's coastal regions, the area contributes to some of the highest rates of per capita solid urban waste generation, ranging from 208 to 760 kg annually (Chatziparaskeva et al., 2022). Projections indicate a substantial surge in population, estimated to reach approximately 572 million residents by 2030. This expansion coincides with two prominent trends—'coastalization' and 'urbanization'— amplifying waste generation and human activities along coastal zones (Setiti et al., 2021; Voukkali and Zorpas, 2021). Unfortunately, the existing waste management infrastructure in these regions frequently falls short of meeting the escalating demands (Setiti et al., 2021). This accumulation poses significant threats, particularly considering the region's heavy reliance on tourism, leading to the deterioration of popular tourist destinations due to coastal and marine waste.

In the Mediterranean context, Cyprus serves as a pertinent illustration, grappling with challenges related to MPs in both coastal zones and agricultural landscapes (Koul et al., 2022). The country's dependence on tourism and agriculture, creates a complex scenario where MPs pose a dual threat to both sectors. As MPs accumulate in coastal areas, they not only disrupt marine ecosystems but also contaminate agricultural lands through various pathways, potentially compromising food security and the pristine allure of tourist destinations (Huang et al., 2023). This entanglement of issues underscores the urgency of addressing MPs pollution comprehensively across diverse environments to safeguard both the economy and the environment (Eisfeld-Pierantonio et al., 2022).

The aim of this research was the development of an inexpensive, fast method with reliably user and environmentally friendly results. During the research, three salt solutions and an oil solution were examined for the extraction of MPs through the process of floatation. Specifically, Canola Oil, Sodium Chloride solution, Magnesium Sulfate solution, and Sodium Hexametaphosphate Solution were evaluated in relation to four types of widely used plastics. The four polymer types used resulted from fragmentation using a grinding mill, clean new plastic containers, or membranes. The experimental procedure for microplastics retrieval differs among the three salts (Sodium Chloride, Magnesium Sulfate, Sodium Hexametaphosphate) and the oil (Canola Oil) (figure 1). Through the multicriteria analysis and based on the criteria used, the NaCl solution scenario emerged as the optimal scenario, followed by the Canola Oil scenario. The recovery method using sodium chloride represented an economical, safe, and reliable method for microplastics retrieval (Stefan et al., 2022; Tong et al., 2017).

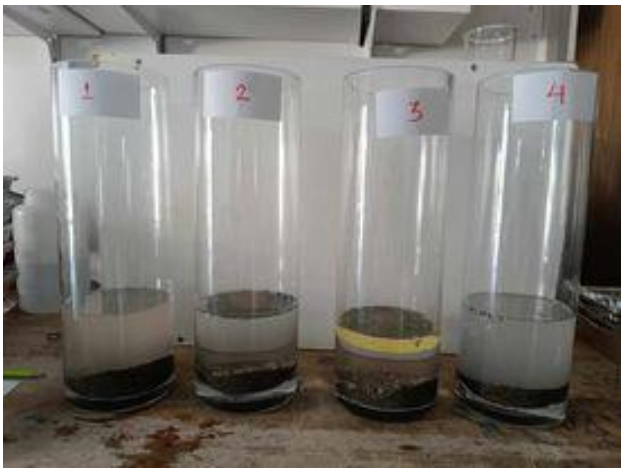

Figure 1: Experimental setup for the comparison of the four methodologies for MPs extraction

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