

Microplastics Degradation Under Artificially Enhanced Photo and Thermal Conditions

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Keywords: Microplastics, Vibrational Spectroscopy, Raman, Degradation

Highlights

- 4000h of UV-A/B exposure caused structural changes and nanoplastic formation
- Raman analysis showed spectral changes in all samples.
- PVC was the most reactive after aging due to its chlorine structure.

Abstract

Plastic is the most consumed and discarded synthetic material nowadays, significantly accumulating in various ecosystems. When exposed to environmental factors, it degrades and fragments, forming microplastics (MPs), < 1 mm.[1] The smaller the particles, the greater their pollution potential. To better understand the aging process of plastic, it is essential to study it under controlled laboratory conditions. In the present study we simulated environmental conditions by exposing pristine PP, PE, PET, PVC, and PS MPs, in aqueous medium, under constant agitation and ultraviolet (UV-A/B and UV-C) radiation and thermal treatment for 4000 hours. After 4000 h of UV-A/B exposure, the morphology of the particles were analyzed by SEM (Figure 1), and cracks and peeling were observed on the surfaces of the MPs, along with a reduction in particle size. These changes led to the formation of nanoplastics, confirming the occurrence of photodegradation. Additionally, the particles were analyzed using Raman microscopy, revealing spectral variations in all samples. PVC exhibited the most pronounced signs of degradation, likely due to the presence of chlorine in its structure. This halogen makes PVC the most reactive polymer, resulting in the greatest divergence after aging.

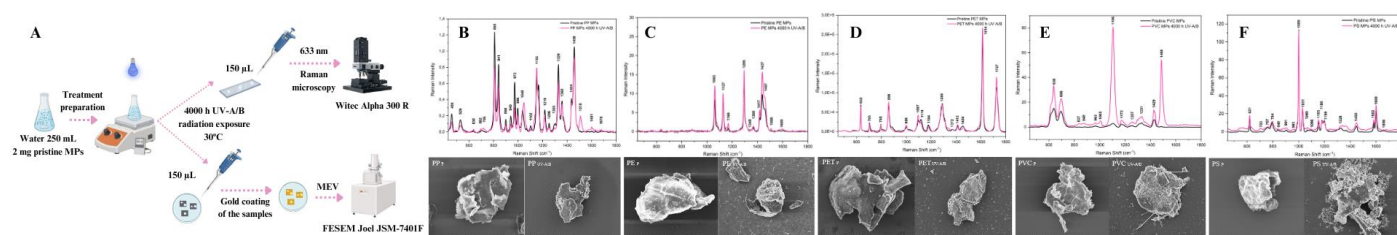


Figure 1. Instrumentation setup for Raman and SEM measurements (A) and Raman spectra and SEM images of PP (B), PE (C), PET (D), PVC (E) and PS (F).

[1]. GESAMP. Sources, Fate and Effects of Microplastics in the Marine Environment: A Global Assessment. 2015. doi: 10.13140/RG.2.1.3803.7925.

Agradecimentos/Acknowledgments

The authors would like to thank CNPq – National Council for Scientific and Technological Development and São Paulo State Research Support Foundation (FAPESP) (Processes 2024/17764-8, 2022/15586-0 and 2022/11983-4) for financial support to the project.