Comparing Different SPME Fibers on Microplastic Standards Using GC-TOFMS

Nathan Venegas | Sebastian Casanova | Dr. Petr Vozka | Department of Chemistry and Biochemistry| California State University, Los Angeles, 90032

Abstract

Plastic does not biodegrade like organic material does, instead it degrades until it becomes small fragments know as microplastics (MP). MPs are becoming an increasing concern because they are found in a variety of environments. They have capabilities of absorbing other compounds like volatile organic compounds (VOCs) and polycyclic aromatic compounds (PAHs). Ways to detect compounds like VOCs and PAHs are through solid phase microextraction (SPME) fibers, one dimensional gas chromatography (GC), and time of-flight mass spectrometry (TOFMS). Understanding compounds absorbed onto MPs starts with the SPME fiber.

Objective

To compare different solid phase microextraction (SPME) fiber on microplastic standards (PP and PET) to see which absorbs more volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs).

Background

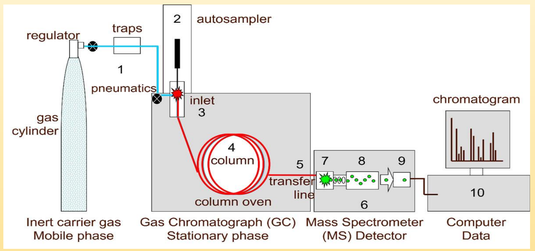
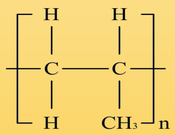


Figure 1. Labeled diagram of GC-TOFMS.

Polypropylene (PP)



Polyethylene Terephthalate (PET)

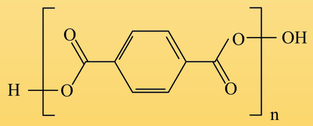


Figure 2 . These are the microplastic standards being studied in this experiment.

Methods

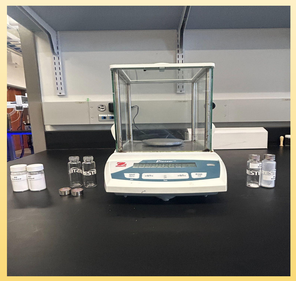


Figure 3. The process of how the microplastic standards were set up.

Methods











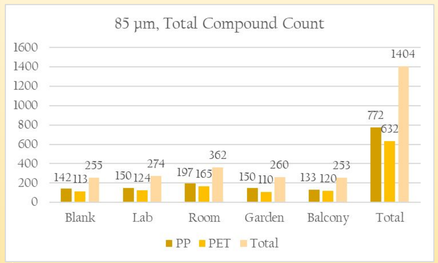
Figure 4. Locations where the microplastic standard were kept. They include the laboratory, outside, a room, and a balcony



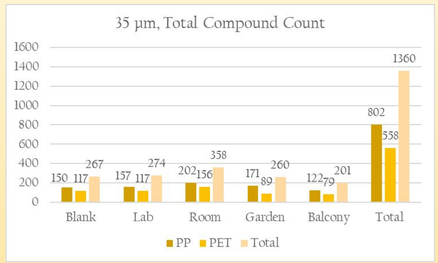
a) b)

FIgure 5. a) Image of a 35 µm SPME fiber used for nonpolar semi-volatile compounds. b) Image of a 85 µm SPME fiber used for polar semi-volatile compounds.

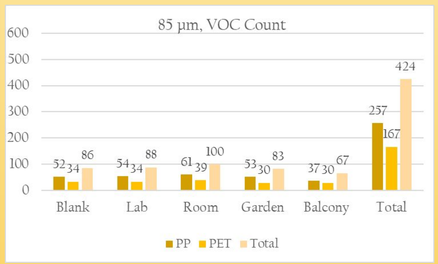
Results



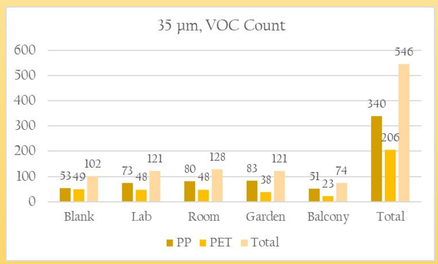
a)



b)

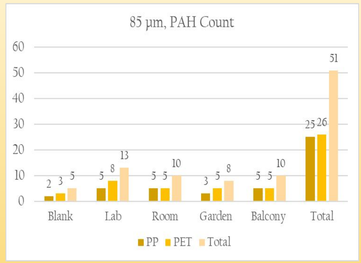


c)

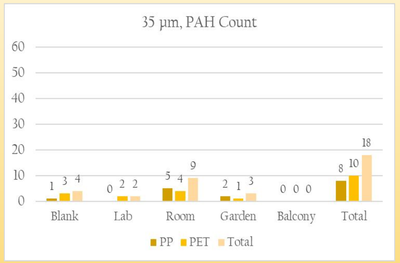


d)

Results



e)



f)

Figure 6. a) Graph of total amount of compound absorbed by MPs 85 µm SPME fiber. b) Total of compounds absorbed on MPs using 35 µm SPME fiber. c) Total VOCs absorbed on MPs using 85 µm SPME fiber d) Total VOCs absorbed on MPs using 35 µm SPME fiber. e) Total PAHs adsorbed on MPs using 85 µm SPME fiber. f) Total PAHs absorbed on MPs using 35 µm fiber.

Conclusion

Based in the SPME fibers that were tested many VOCs and PAHs were absorbed. This is useful when trying to find the abundance of VOCs and PAHs in MPs in our environment that can be harmful to humans.

Future Works

For future works I would like to repeat this experiment using a wider range of SPME fibers. As well as run MPs samples with the wider range of fibers on samples on Pyr-GCxGC-TOFMS

References

1. Nguyen, B.; Claveau-Mallet, D.; Hernandez, L. M.; Xu, E. G.; Farner, J. M.; Tufenkji, N. Separation and analysis of microplastics and nanoplastics in complex environmental samples. *Acc. Chem. Res.* **2019**, *52*, 858-866.
2. Zhang, X.; Zhang, H.; Yu, K.; Li, N.; Liu, Y.; Liu, X.; Zhang, H.; Yang, B.; Wu, W.; Gao, J. Rapid monitoring approach for microplastics using portable pyrolysis-mass spectrometry. *Anal. Chem.* **2020**, *92*, 4656-4662.
3. Turner, D. *GC-MS Principle, Instrument and Analyses and GC-MS/MS*. Analysis & Separations from Technology Networks. https://www.technologynetworks.com/analysis/articles/gc-ms-principle-instrument-and-analyses-and-gc-msms-362513.
4. Fan, W.; Salmond, J. A.; Dirks, K. N.; Cabedo Sanz, P.; Miskelly, G. M.; Rindelaub, J. D. Evidence and mass quantification of atmospheric microplastics in a coastal New Zealand city. *Environ. Sci. Technol.* **2022**, *56*, 17556-17568.
5. Jones, N.; Wendt, J.; Wright, S.; Hartner, E.; Groeger, T. Analysis of Microplastics in Environmental Samples by Pyrolysis/Thermal Desorption-(GC) xGC-TOFMS. *Chromatography Today* **2021**, *14*, 36-40.

Acknowledgements

A special thank you to the following organizations and people for giving this opportunity. Without it none of this would have been possible:

- Minority Opportunities in Research (MORE) Programs at California State University, Los Angeles
- Undergraduate Research Training Initiative for Student Enhancement (URISE)
- Complex Chemical Composition Analysis Lab (C³AL) and Dr.Vozka
- National Institute of Health

C³AL
COMPLEX CHEMICAL COMPOSITION ANALYSIS LAB