

Introduction

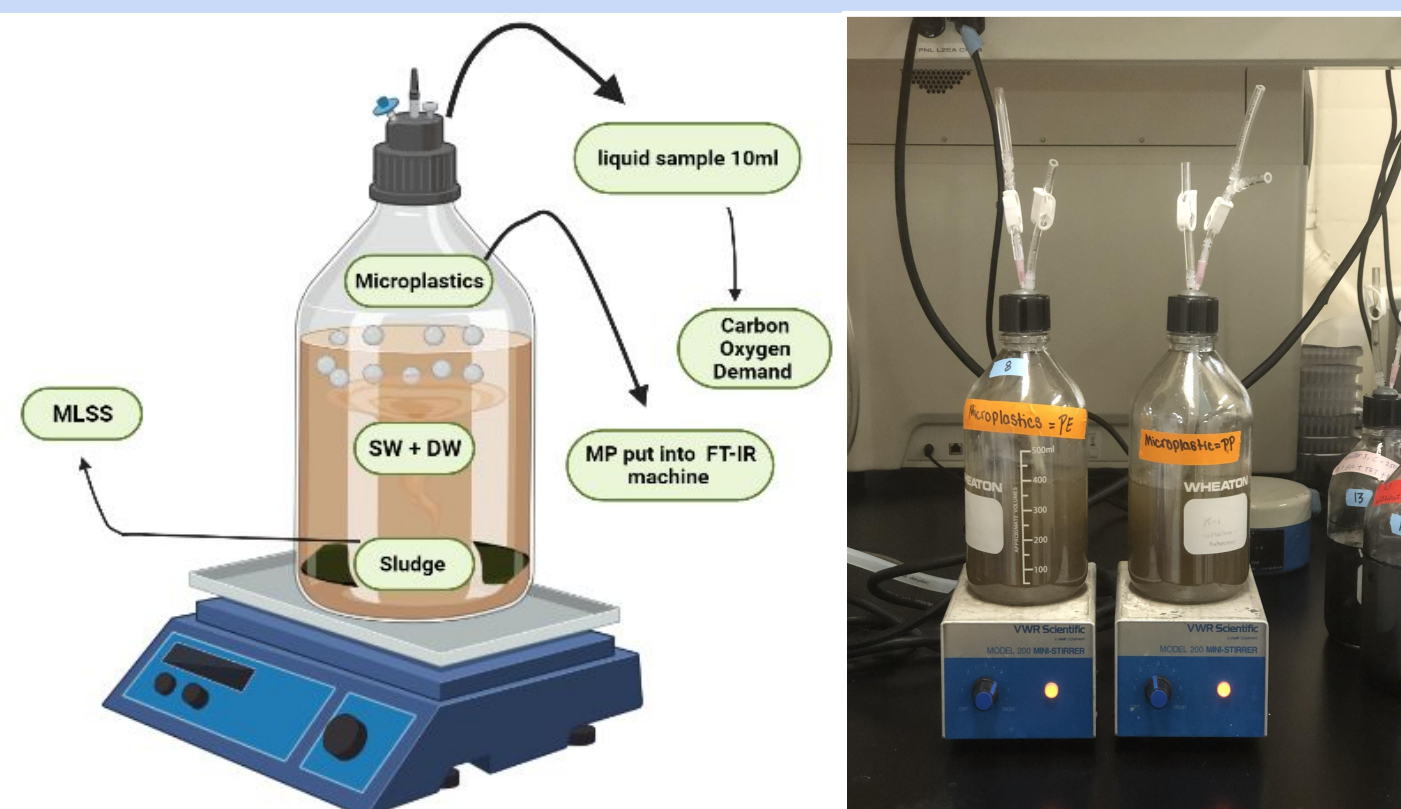
Plastic pollution is one of the most pressing environmental problems of the 21st century. Plastics with the size between 5 mm - 0.1 μ m can be defined as microplastics. Significant amounts of microplastics can be found in wastewater treatment plants, landfills and food waste. Anaerobic digestion is a biological process that uses bacteria to treat water and degrade the contaminants found in it with the absence of oxygen. It can solve contamination problems by using the microbes inside of water to degrade the contaminant. Anaerobic digestion allows for wastewater to stabilize and create by products.

Materials and Methods

Mixed Liquor Suspended Solids (MLSS): to measure the amount of solids present in the reactors

Chemical Oxygen Demand (COD): to estimate the required amount of oxygen for the portion of organic matter in wastewater to be degraded

Fourier Transform Infrared Spectroscopy (FT-IR): to analyse the chemical structure and changes in bonds in polymers/microplastics



Skills Learned

1. Successfully set up bioreactors to perform the experiment
2. Pipetting (changing the amount the liquid in pipet)
3. Vacuum filtration (setting the vacuum pump up and gathering materials) using the vacuum filtering machine
4. Analyzing the microplastics using the Fourier Transform Infrared Spectroscopy

Results and Discussion

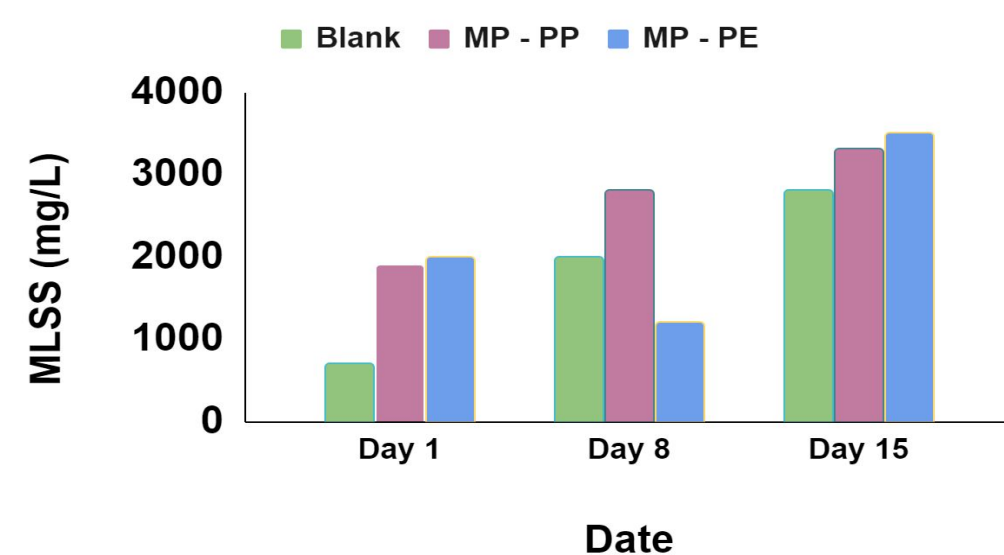


Figure 1. MLSS in reactors over time.

COD graph shows the change of the energy source that were available throughout the course of 15 days.

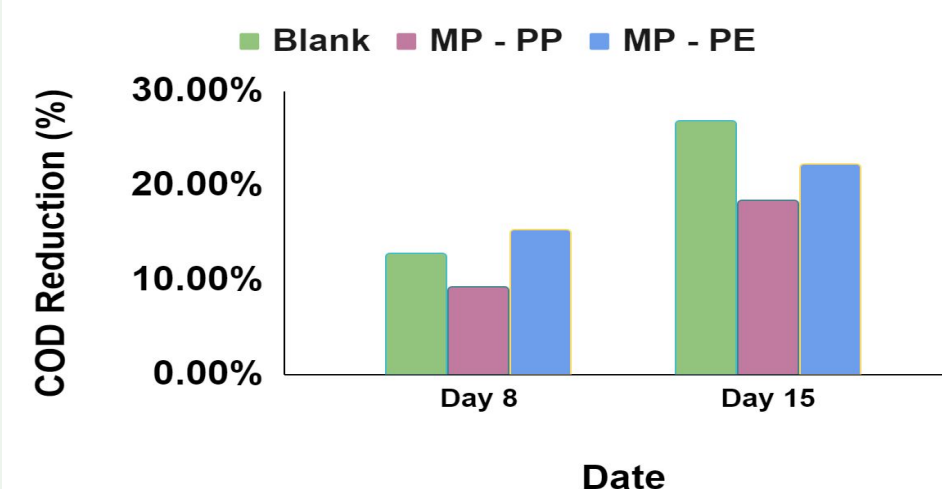


Figure 2. COD reduction in reactors over time.

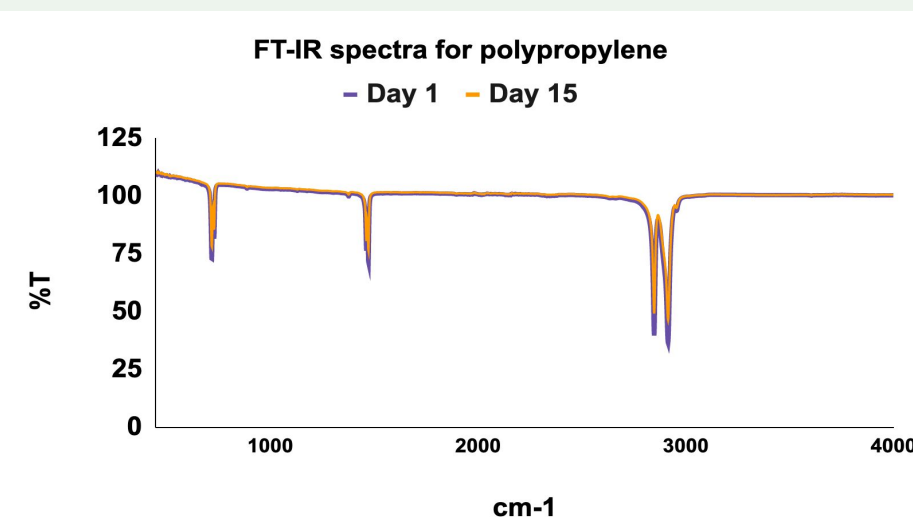


Figure 3. FTIR spectra for Polypropylene

Stretching in CH_2 bond at $\sim 2980 \text{ cm}^{-1}$, and $\sim 1480 \text{ cm}^{-1}$ can be clearly observed by day 15.

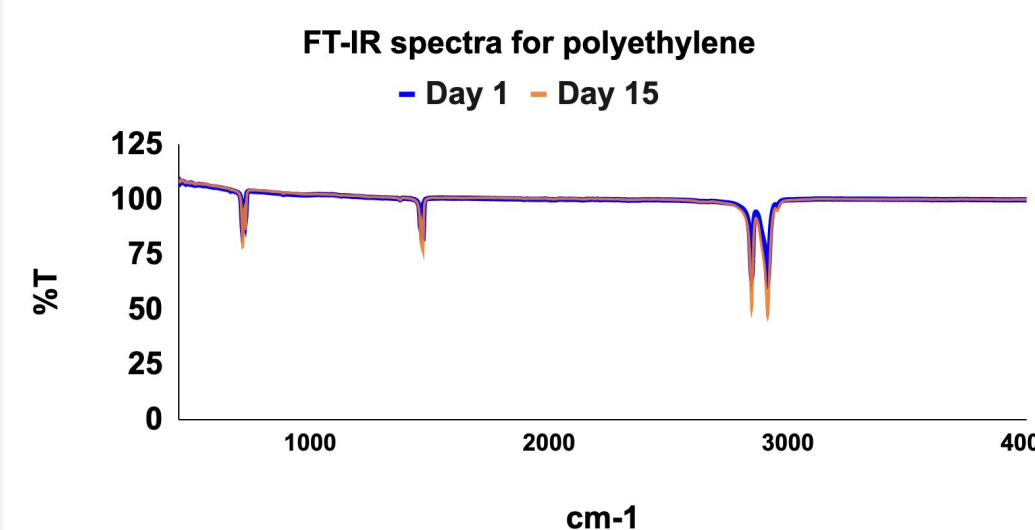


Figure 4. FTIR spectra for Polyethylene

Conclusion

Anaerobic bioreactors present emerging technology with a potential to improve energy efficiency and effluent reuse as their high-quality, nutrient-rich effluents can be utilised for direct irrigation with low environmental impact and improved microbial pathogen removal. Microplastics are almost non-biodegradable which invites more challenges in various environmental streams. Our experiment evidenced a decrease in organic compounds but no changes in physical structure and minor changes in chemical properties of polyethylene and polypropylene under anaerobic treatment for 15 days.

Next Steps and Advice for Future SHINE Students

My Future Plans

I hope to continue doing well in my science classes and taking classes apart from the default ones which will help me to be a part of such research programs. In the future one of my goals is to research water, specifically in Central America. I see myself learning and utilizing my skills to solve the environmental issues.

Advice for Future SHINE Students

- Come mentally and physically prepared. It will be a lot of information
- There will also be a lot of standing, so it important to eat and drink plenty of water
- Takes notes and have them organized

Acknowledgements

I would like to thank Mr. Steven Dorfman and Arlene & Angie- my Telacu advisors for encouraging me to be a part of such research program to gain knowledge and experience. Dr. Katie Mills and my SHINE Lab Ph.D mentors for spending their time to explain the concepts in a way that I understood. Also, I thank my teammates for making this whole experience less nerve wracking and really exciting.

Citations

Golwala, H., Zhang, X., Iskander, S. M., & Smith, A. L. (2021). Solid waste: An overlooked source of microplastics to the environment. *Science of the Total Environment*, 769, 144581.