

Increasing the Detection Rate of Microplastics Using Organic Solvents To Expand Their Structure

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Introduction

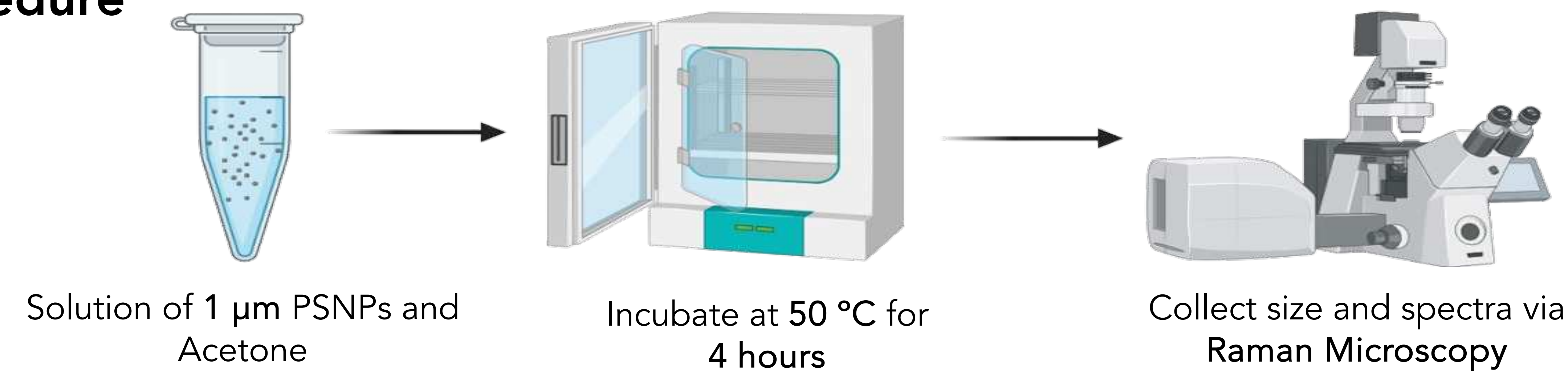
- Microplastics are formed due to degradation of plastic products.
- **Detecting microplastics is difficult** due to their small size. Existing detection and characterization techniques are dominantly size-sensitive, thus complicating our ability to accurately gauge their prevalence in food, our bodies, and the environment.
- The **core objective** is to establish an efficient method for the detection and identification of small Polystyrene Microplastics.

Hypothesis and Method

- Hypothesis: Use acetone, a known solvent of Polystyrene, to expand microplastics' structure with the goal of achieving an amplified Raman signal.
- To establish a reliable and replicable procedure, experimentation was undertaken, involving variations in incubation time, temperature, and microplastic size.
- The optimal combination yielded the most effective method by which microplastics can be detected via solvent expansion.

Temperature	Time	Size
50 °C	14 hrs.	10 µm
60 °C	8 hrs.	1 µm
70 °C	4 hrs.	

Procedure

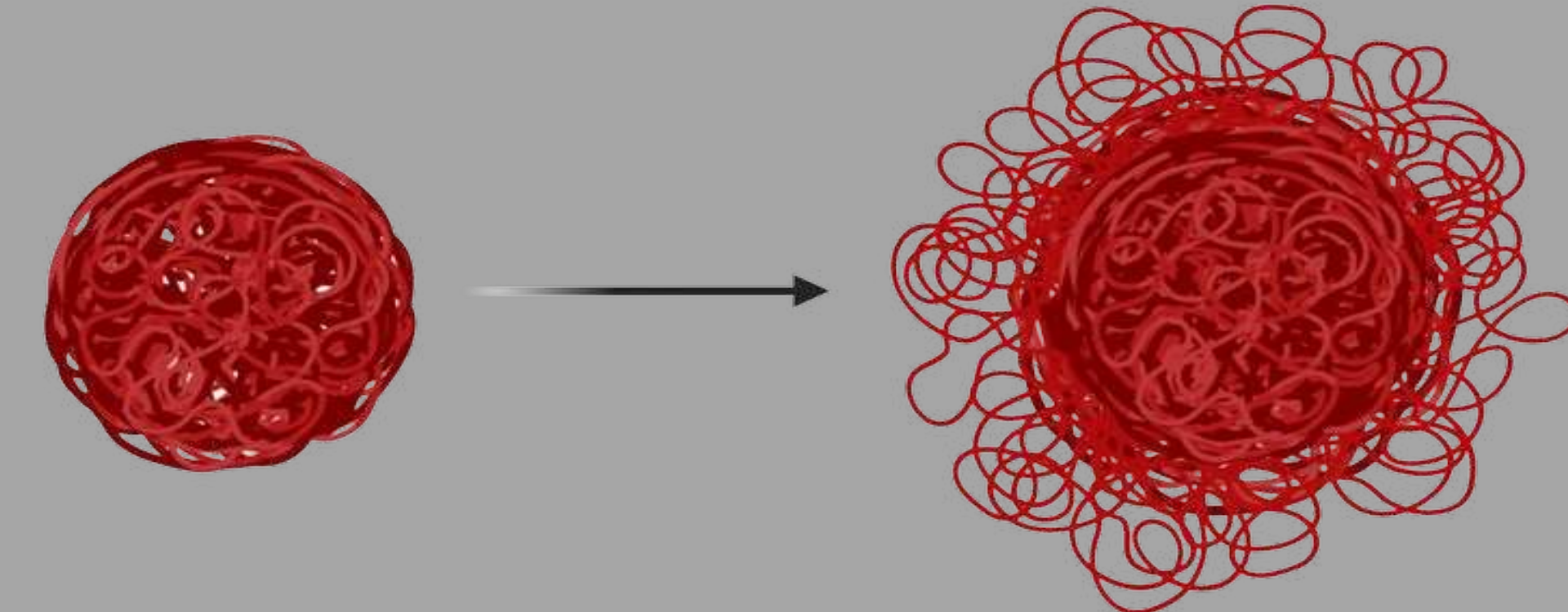


Results

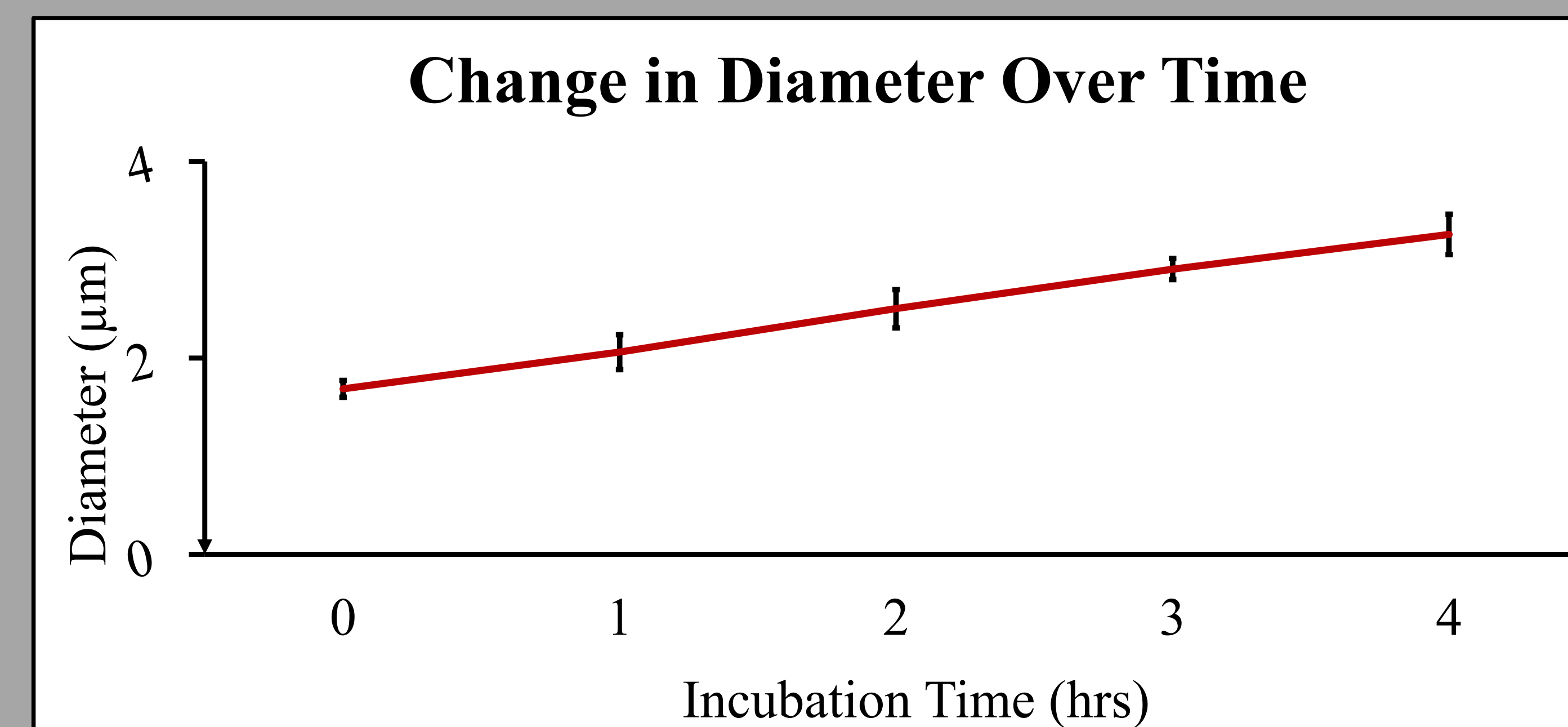
Increase in Diameter

Start

4 Hours



During incubation, Acetone dissolves the bonds between the Polystyrene polymers causing a jelly-like outer layer composed of disentangled chains to form.

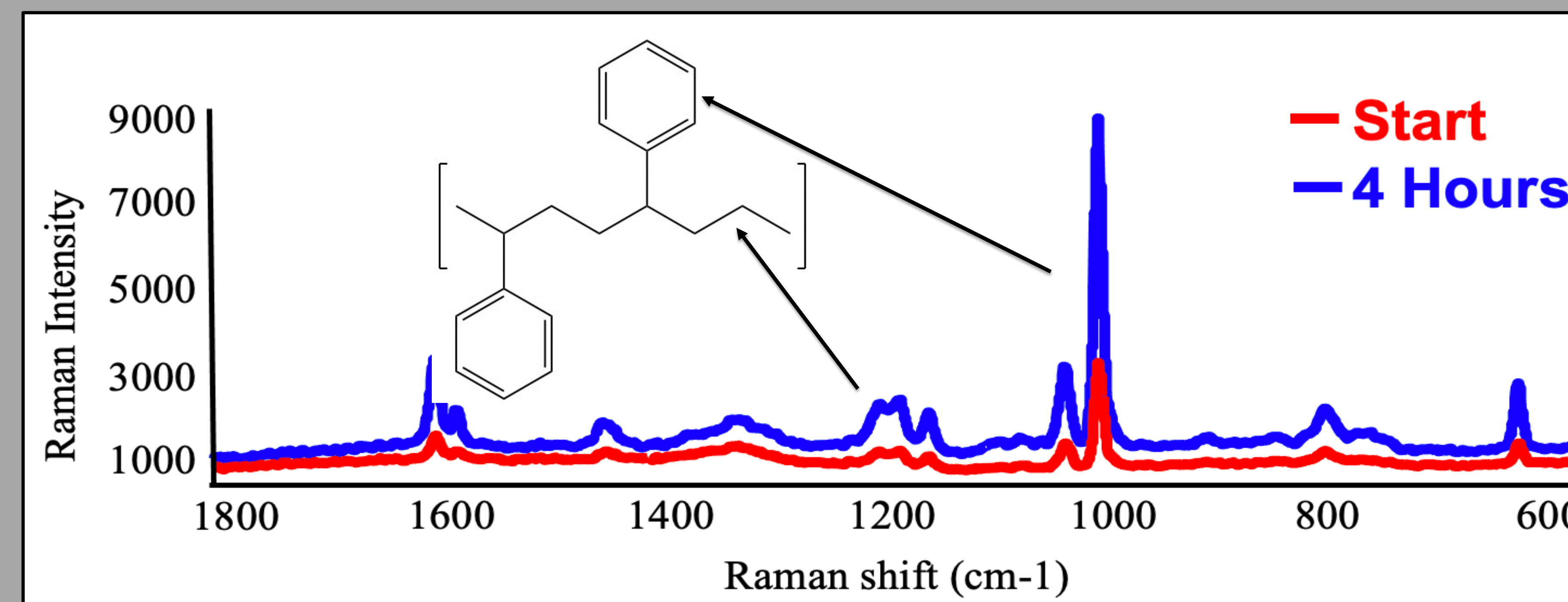


An average increase in diameter of 1.6 µm was observed due to the outer layer formation.

Amplification of Raman Intensity

Expansion of the Microplastics caused observed amplification of Raman Intensity

Each chemical structure has a unique Raman Spectra. For this reason, it is used to determine if an unknown sample contains Microplastics and what type of Microplastics are present.



Conclusions

- An effective method has been developed to increase detectability of Polystyrene microplastics.
- After 4 hours of incubation, acetone expanded the microplastic's diameter to approximately 2X its' initial size.
- Following incubation with acetone, the Raman Intensity increased to 3x its' initial Intensity.

Future Work

- Use Hansen's Solubility Parameter to estimate more thermodynamically stable solvents that may perform the objective more efficiently.
- Experiment with other plastic types to find the most effective solvent for practical use.

Acknowledgments

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Food Science



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