Problem

Millions of particles of microplastics pollute the environment from human activity. Although they can be filtered out, it is difficult to do so efficiently.

Goal

The aim of this project is to engineer a reusable apparatus that is portable and filters microplastics from water efficiently.

Purpose

The purpose of this project is to limit the amount of microplastic that enters the environment by filtering it out of water before it can reach other bodies of water. The device may also be used in the environment to filter some of the microplastic already present.

Filtration of Sample 1

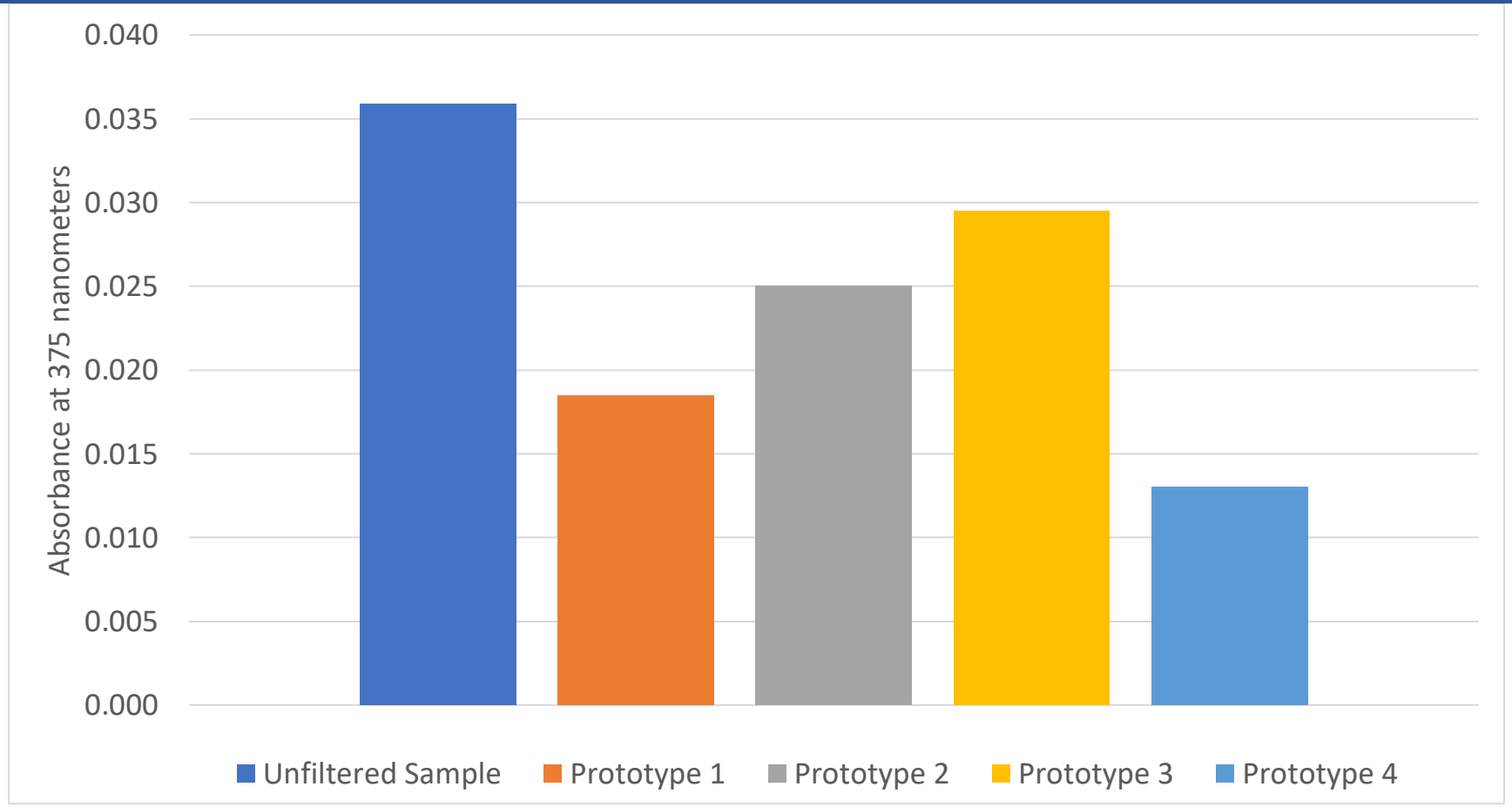


Figure 1. A comparison of the optical density of the least concentrated microplastic sample when filtered through the different prototype.

Filtration of Sample 2

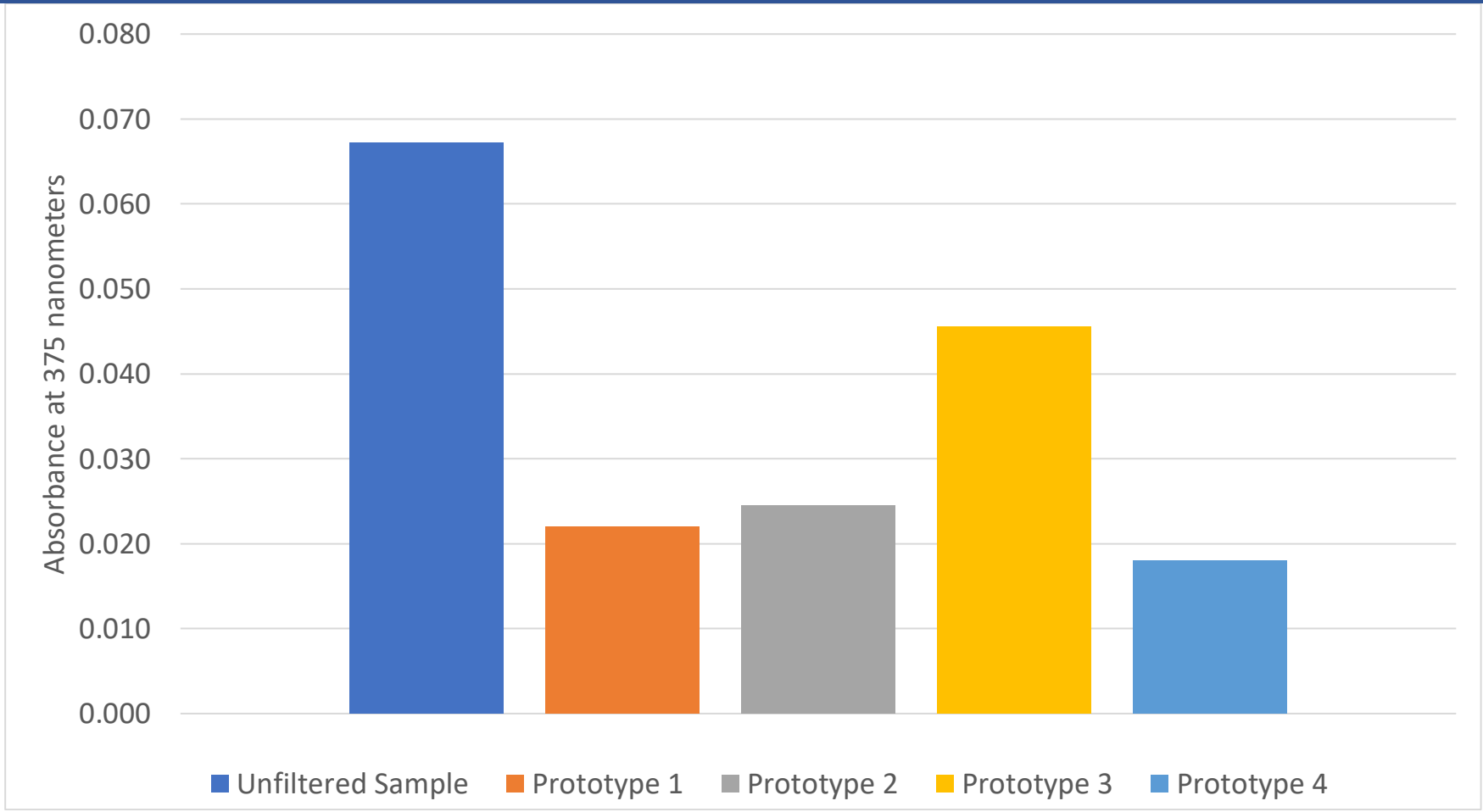


Figure 2 A comparison of the optical density of the most concentrated microplastic sample when filtered through the different prototype.

Decision Matrix

	Prototype Designs	Design 1	Design 2	Design 3	Design 4
Criteria	Max	**A**	**B**	**C**	**D**
Efficient	10	8	5	4	7
Low Cost	9	5	4	6	2
Safe	5	5	5	5	5
Prone to Rips	7	4	6	3	2
Prone of Clogging	7	5	3	3	2
Effectiveness	10	6	5	3	8
	Total	33	28	24	26

Filtration of Sample 3

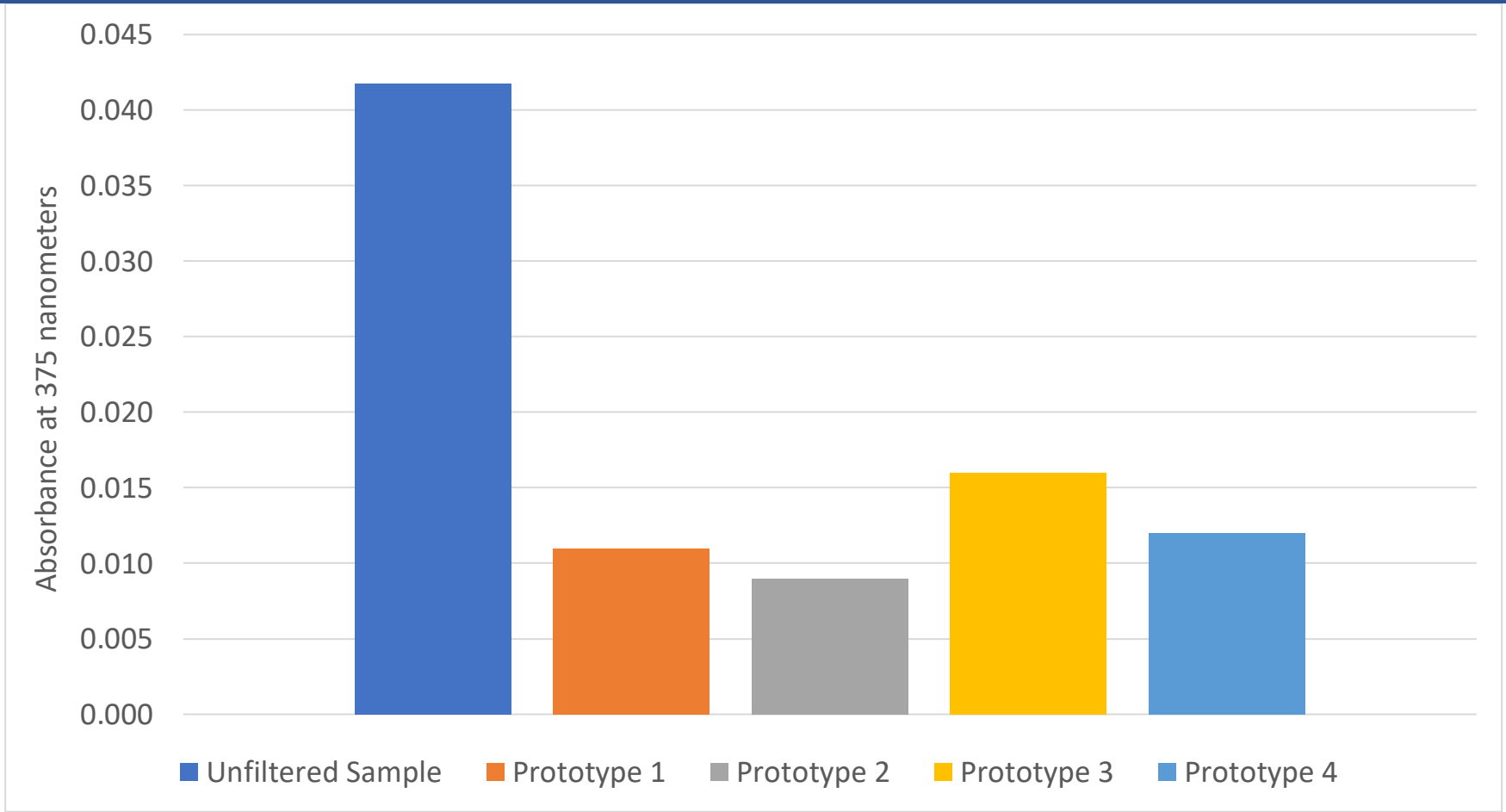
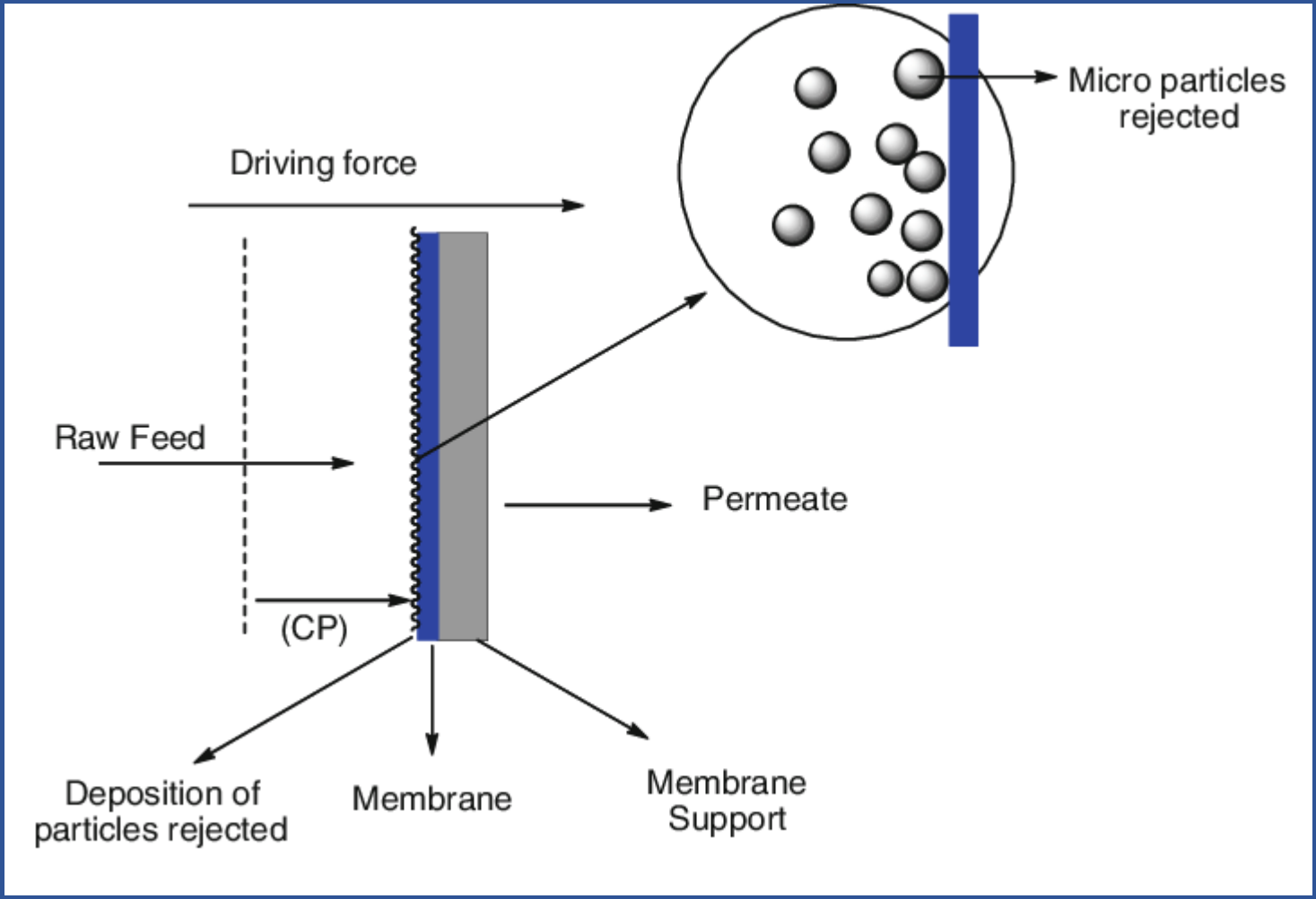


Figure 3. A comparison of the optical density of the medium concentrated microplastic sample when filtered through the different prototype.

View More

Membrane Filter



Sources of Error

Contamination:

- The tea bags may have residue from tea remains.
- Plastic containers may have added more microplastic to samples

Rips and clogging

- Membranes may have ripped and clogged which decreases effectiveness.

Analysis

Prototype 4 (combination of all 3 membranes) was overall the most effective, but it also used the most membranes.

- However, T-tests revealed that there was no statistical difference between the 4^{th}, 2^{nd}, and 1^{st} prototype.

Prototype 1 was the most cost efficient because it had the largest pore sizes, but also produced similar results to 2 and 4.

Prototype 3 was shown to be the least effective, but it contained the membrane filters with the smallest size.

- A paired T-test with prototype 4 showed that there was a statistical difference between the two with a p value of 0.023

Future Work

Pore size

- More membranes with different pore sizes can be tested for cost and filtration efficiency

Filtration Capacity

- The membranes can be tested for the amount of plastic they can filter before clogging.

Application

- The membranes used in prototype 1 can be made into an apparatus that can attach to a household object like the washer.
- Devices with larger membranes can be tested to explore the effectiveness of the filters at a larger size.

Filtering

microplastics

using a

Semipermeable

membrane filter

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