SiMPore
Precision Membrane Technologies

Parverio
Small Revelations

Microplastics in Drinking Water:

Do Household Pitcher Filters Really Work?

Introduction

As consumers become aware of the depths of the microplastic pollution problem, many are finding themselves increasingly concerned with microplastics in their drinking water. They may turn to readily available tap water filtration methods in order to keep potentially harmful microplastic contamination away from themselves and their families.

This study evaluates the effectiveness of 5 commonly used pitcher filter types on the market in removing microplastic beads from drinking water. SiMPore and Parverio partnered together to utilize SiMPore's silicon nitride filters for microplastic particle capture, and Parverio's proprietary image analysis methods for this study.

Results

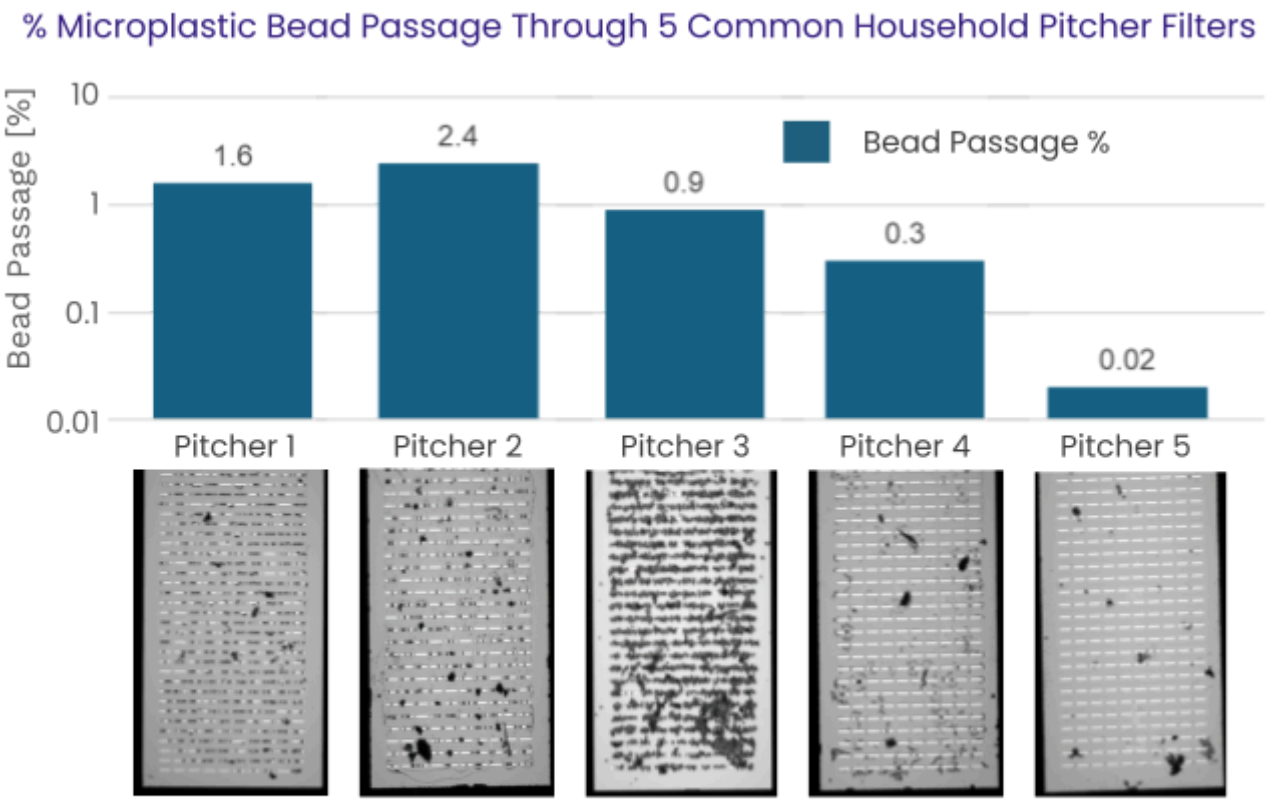

Figure 1: 1 L of water containing 2-9 µm microplastic (MP) beads filtered through 5 different pitcher filter brands. 50 mL of the filtrate from each pitcher was collected and then filtered on SiMPore's 8.0 µm silicon nitride membranes (MPSN400-3:-8.0-NON). Microscope images of each membrane then analyzed via Parverio's image analysis software for MP bead presence. Both beads and pitcher filter shed is pictured on each membrane snippet.

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Results cont.

Rating of Pitchers starting with highest % removal of Microplastic beads:

Pitcher 5 (99.98%), Pitcher 4 (99.7%), Pitcher 3 (99.1%), Pitcher 1 (98.4), Pitcher 2 (97.6%)

Some pitcher filters also shed particles from the filter itself, as shown by the morphology of the captured particles. The non-bead particles were not counted.

Some of these non-bead particles may also be plastic in origin, as some filter types can be made in part with plastic components. Other particle types that could be released by the filters may be charcoal, resin, or other various types of filtration media shedding, based on the composition of the filter in question.

Conclusions

Commonly available Pitcher Filters have a degree of variability in their ability to successfully filter out microplastic beads. Pitcher 5 removed over 120x more microplastic beads than Pitcher 2. However, all pitchers in this study removed over 97% of microplastic beads from the water samples!

Methods

- Conditioned Pitchers according to Manufacturer's instructions with Tap Water.
- $1.3x10^6$ beads suspended (2-9 µm in diameter) in Particle-free water.
- Filtered 1 L of the above solution through each pitcher filter.
- 50 mL subfraction of filtrate collected, then filtered using SiMPore MSSN400-3L-8.0-NC membranes.
- Nile Red stain applied (0.1 ug/mL), washed 3x with microplastic-free water.
- Imaged using Brightfield/Fluorescence TRITC filter on Olympus microscope.
- Analyzed images using fluorescence threshold and ML-based pixel classification (Fiji, ImageJ)
  - Denoising, Despeckling, Background Correction, Erosion, Dilation operations applied.
  - Pixel classifier trained on 4 and 8 pixel structures.
    - Min/Max/Mean/Difference of Gaussians/Gaussian Blur/Laplacian/Hessian.
    - Manual training to focus on bead structures, not other debris/slots.
    - Same classifier applied to each set of images to increase specificity.
  - Thresholded Grayscale Image Processed, size selected for 8 µm beads, circularity, and diameter.
    - Watershedding, despeckling, binary erosion dilation

About

SiMPore Inc.

SiMPore's mission is to develop and deliver products for the analysis of nanoscale specimens, enabling the discovery of the future in material and life sciences. The Company offers a variety of filters for capture and analysis of particulates of interest, as well as substrates for electron microscopy.
Learn more at www.simpore.com

Parverio Inc.

Parverio is tackling the emerging problem of microplastic contamination with unique technology and analysis offerings.
Learn more at www.parverio.com

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The content is solely the responsibility of SiMPore Inc. and Parverio Inc. and does not necessarily represent the official views of the National Institutes of Health.

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