Fractionated filtration for isolation of microplastics from bottled water

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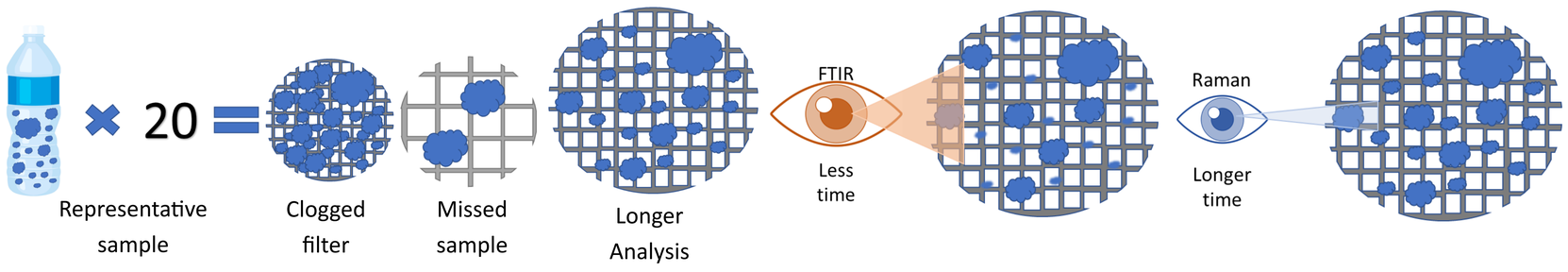
Abstract

Plenty of research has been performed to **quantify microplastics in bottled water**. Therefore, general practices for microplastics analysis have been proposed to ensure reliable results and a standardized method. An adequate sample volume is a relevant parameter as the microplastics concentration per size range varies with it, being higher for small particles (<100µm) and lower for large particles (>300µm). Therefore, a representative volume of the sample is needed to estimate correctly the content of particles. In this work, an **isolation methodology of fractionated filtration** is implemented **for bottled water** processing to ease the processing of larger sample volumes and reduce sample contamination by limiting the contact of the sample with the environment during the filtration. The experimental process compares the performance of the traditional fractionated filtration in sequential filtrations to the method proposed.

Problem



Objectives

- To achieve a method without sample contamination usually present in fractionate filtration that applies the quality
- To enable the use of different analytical methods that target different particle size ranges (x>10µm, 10µm>x>5µm, and 5µm>x>1µm)
- To ease the processing of 10 Lt sample from bottled water for time and resource optimization

Methodology

Quality measures:

Sampling:

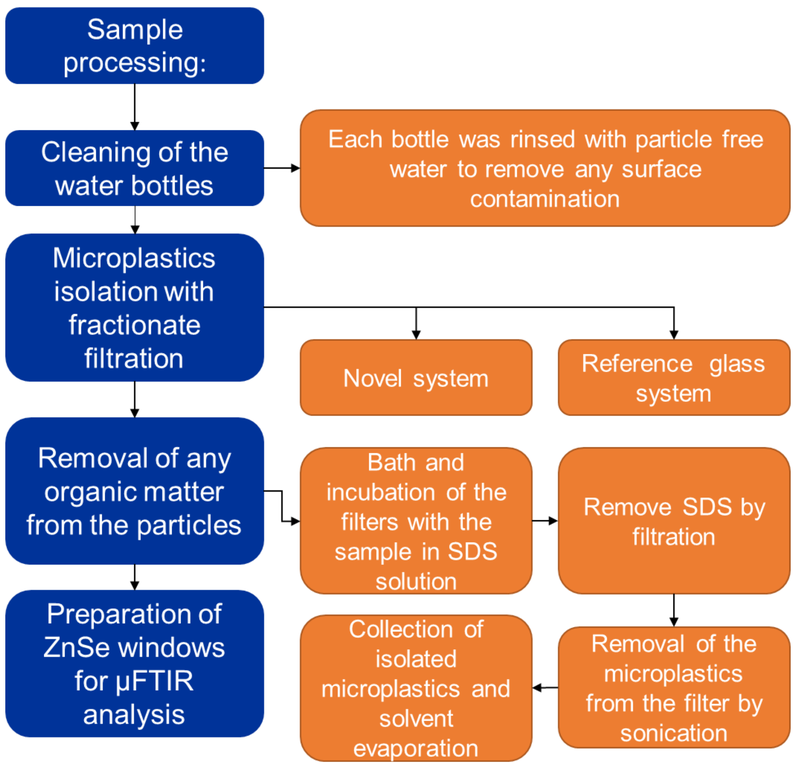
Purchasing locally 60 liters of bottled still water separated in 120 bottles of 0.5 Lt from the same brand and batch. Each method had 3 replicates of 10 Lts.

Processing:

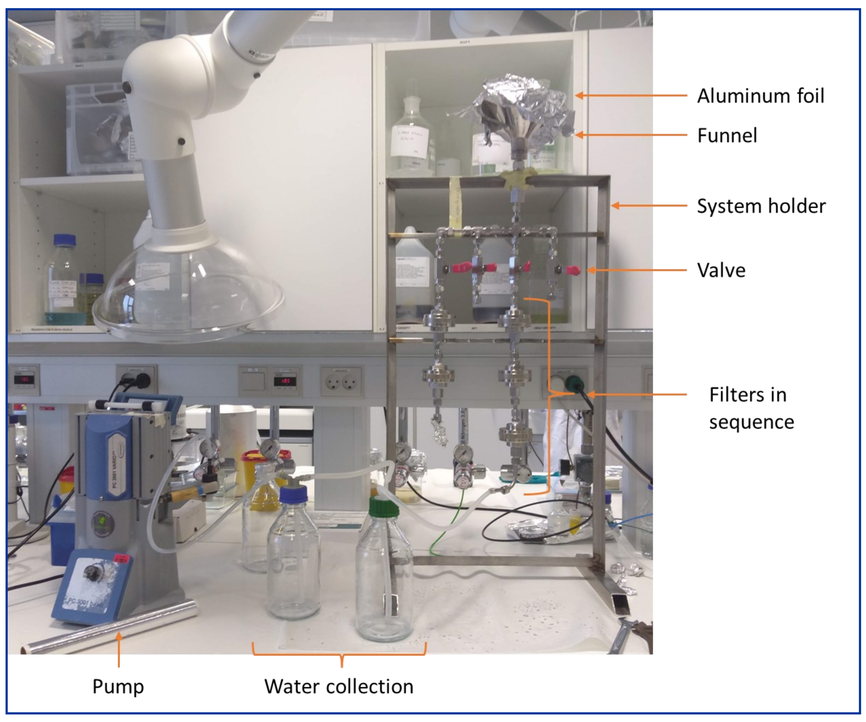
- Muffle the pieces of the novel and the reference system to avoid contamination
- Each system had a blank to reference the sample contamination done with MiliQ water
- The chemical processing was performed in a lab air-bench avoiding any plastic utensilts

Analysis:

- Focal plane array FTIR microscope
- Analysis software siMPle
- Library of about 500 different spectra [3]



Novel system



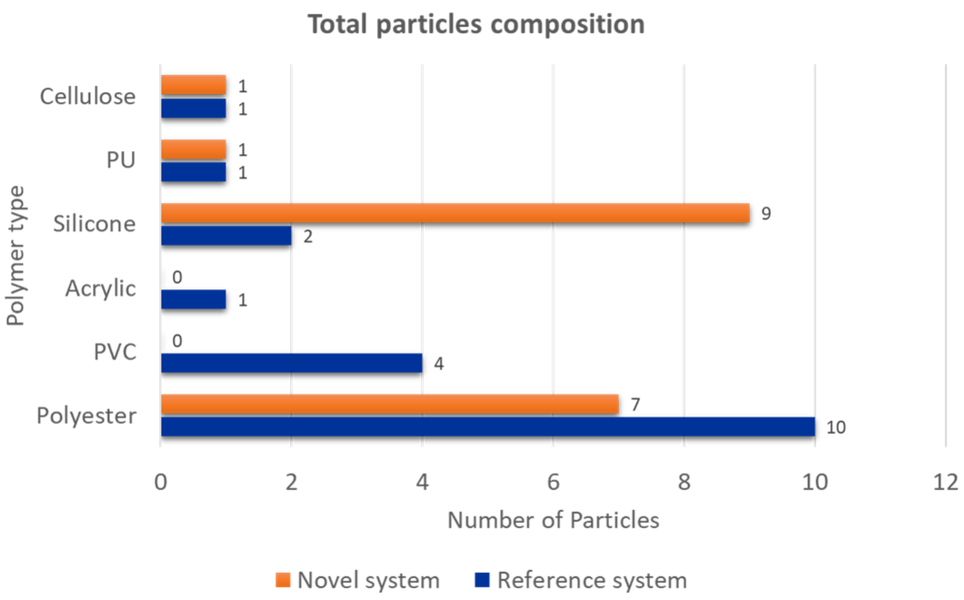
Reference system

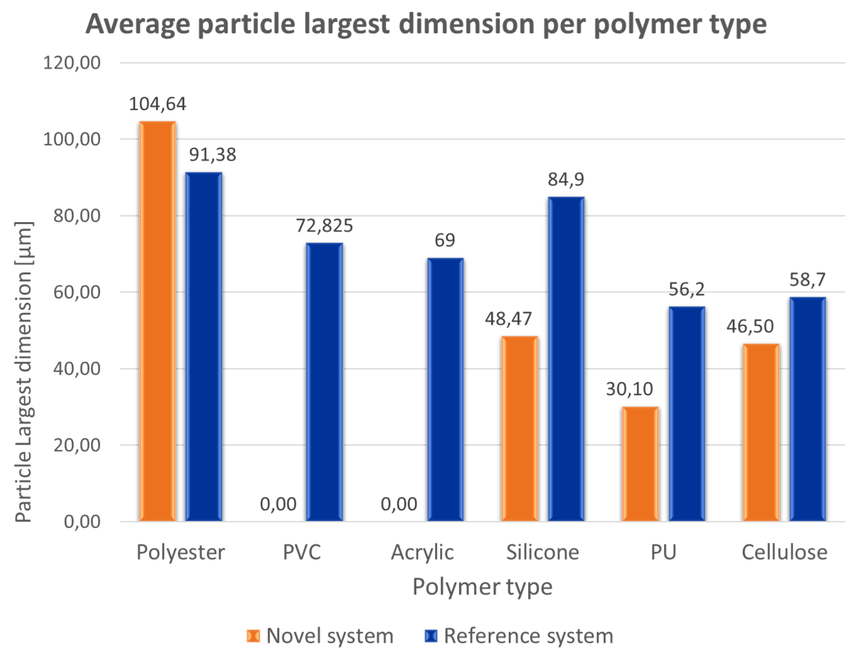
Six filtration units from the reference system were used.

Results

Monitoring for contamination:

The blanks presented 2MP (in the novel method) and 4MP (in the reference system) of PET and PVDF (poly vinyl Fluoride). The spectra of these materials were removed from the later analysis.





Conclusions:

The consistency of the polymer types and size range of the particles found with both methods demonstrated that the novel method performs as good as the traditional method used.

The small amount of foreign microplastics observed in the blank evidences that this method avoids efficiently the foreign contamination that is usually present in fractionate filtration methods.

The results from the analysis of microplastics content in bottled water agree with the literature, showing a small amount of "large" microplastics with an inhomogeneous distribution. This indicates that possibly a larger sample than 10Lt is needed if they are the target of the analysis.

References:

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[3] Kirstein, Inga V., Fides Hensel, Alessio Gomiero, Lucian Iordachescu, Alvise Vianello, Hans B. Wittgren, and Jes Vollertsen. "Drinking plastics?–Quantification and qualification of microplastics in drinking water distribution systems by µFTIR and Py-GCMS." Water research 188 (2021): 116519.

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