Testing the use of Sodium Polytungstate for an efficient extraction of microplastic particles from river sediments

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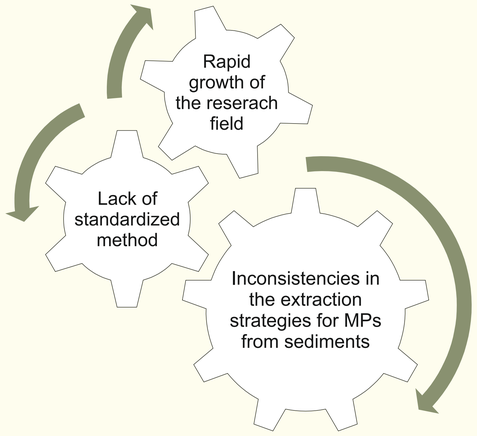
Introduction

Rivers:
- Primary pathways of MPs to the sea[1, 2, 3],
- Reservoirs of MPs stored in sediments[4,5].

Kowing microplastics content in river sediments is critical.

The optimization of a methodology for the separation and classification of microplastics from sediments is crucial.



Several studies highlight that density separation using a high-density concentrated saline solution is one of the most reliable and efficient separation methods[6, 7, 8, 9].

Aim of the Study

Testing the use of Sodium Polytungstate as a density separation agent.

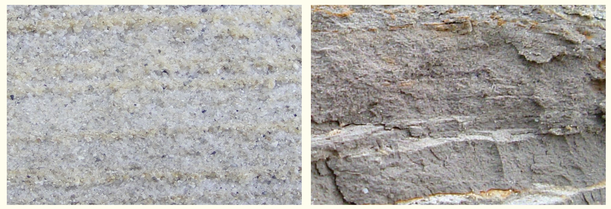
What is the recovery rate of this method?

Methodology

1. Creation of artificial sediments

20-25 grams of sediment plus 50 MPs per sample for a total of 52 samples

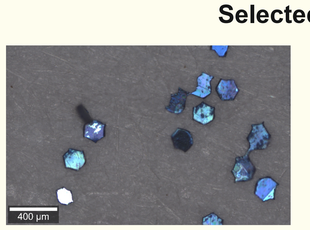
Plastic-free sediments
(Pleistocene alluvial deposits)



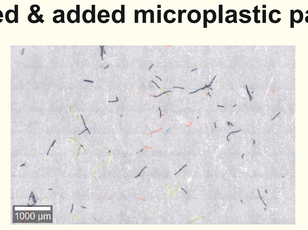
Used particle size ranges

- Mixture A: 63 - 250 µm
- Mixture B: lower than 63 µm
- Mixture C: 50% A + 50% B

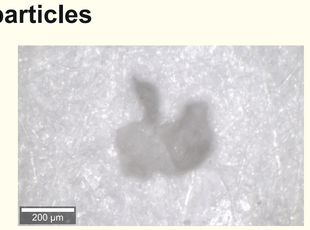
Selected & added microplastic particles



PET films
(ρ = 1.38 g · cm^{-3})



PET fibres
(ρ = 1.38 g · cm^{-3})



PVC fragments
(ρ = 1.4 g · cm^{-3})

2. Organic matter removal

Wet Peroxide Oxidation[10,11]

$H_2O_2 + Fe^{2+}$

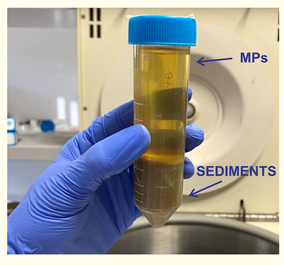
50 - 70 °C

< 4 h

3. Density separation

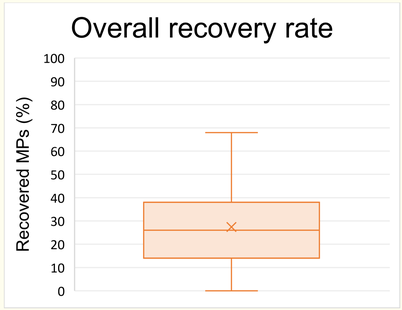
Sodium Polytungstate (ρ from 3.1 g · cm^{-3} to 1.6 g · cm^{-3})
- Indermediate density between sediments and plastic[12,13],
- Non-toxic[12,13],
- Easily recoverable and reusable[12,13],
- Successfully used for the separation of minerals and rocks[13].

The procedure:
- Addition of the liquid to the samples, centrifugation and settling,
- Collection of the suspended particulate matter,
- Transfer of the suspension to cellulose filters,
- Microplastics counting under a stereomicroscope.



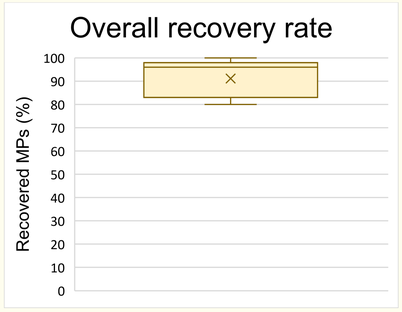
Preliminary Results

Procedure 1



- Test tube capability: 50 ml,
- 25 g of sediments,
- 50 microplastic particles.

Procedure 2



- Test tube capability: 500 ml,
- 20 g of sediments,
- 50 microplastic particles.

Conclusions

Procedure 1

Low recovery rate due to:
- MPs trapped in sediments,
  - Test tube capability (50 ml) vs the amount of sediments (25 g).
- MPs dispersion during different steps.
- Too strong organic matter removal,
  - Destruction of the several layers of wich glitters are made of.

Procedure 2

High recovery rate due to:
- Use of the same container for all the steps,
- Larger containers: 500 ml,
- Lower amount of sediments (20 g).

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