MICRO2020 INTERNATIONAL CONFERENCE
23-27 NOVEMBER 2020 LANZAROTE AND BEYOND*

Strategies for the separation of microplastics from water via density modification

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Introduction

Wastewater treatment plants (WWTPs) are important **sources of microplastics (MPs)** into the environment

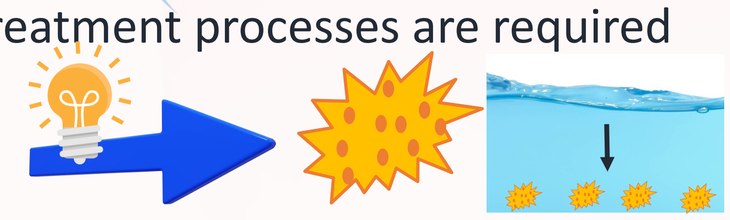
520 ktons/year are released in **European WWTPs** effluents [1]

Rivers transport up to 90% of the global **MPs** load into the **sea** [2]

Innovative water treatment processes are required

Floating solids

Low reactivity *Low size*



Could they be separated by **modifying their density?**

Experimental

Experiments

- VOLUME: 1.5 mL
- MP DOSE: 10 mg
- Mineral DOSE: 20 mg

Minerals

Hematite (Fe_2O_3) $\rho = 5.2$ kg m^{-3}

Ilmenite ($TiFeO_3$) $\rho = 4.6$ kg m^{-3}

Obtention of microplastics

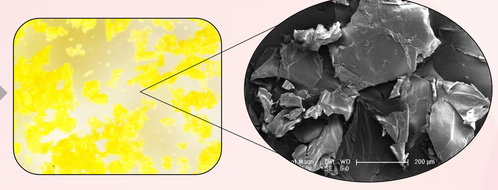
Cryogenic grinding of commercial plastics

Size range: 20 – 1000 μm

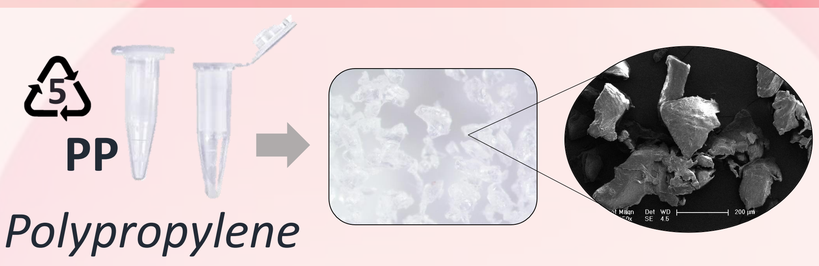
Results

MPs characterization

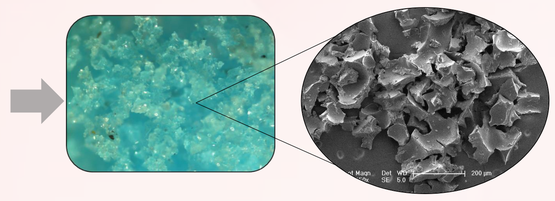
6 PS *Polystyrene*



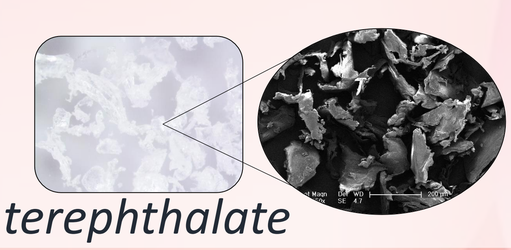
5 PP *Polypropylene*



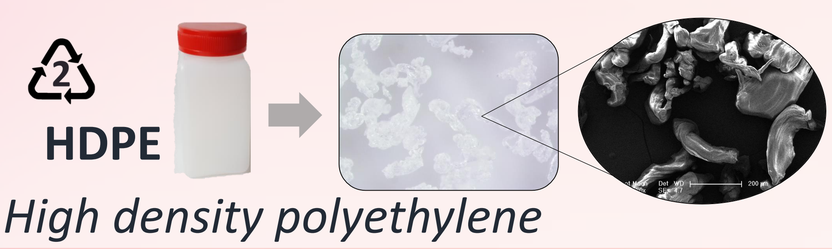
7 PU *Polyurethane*



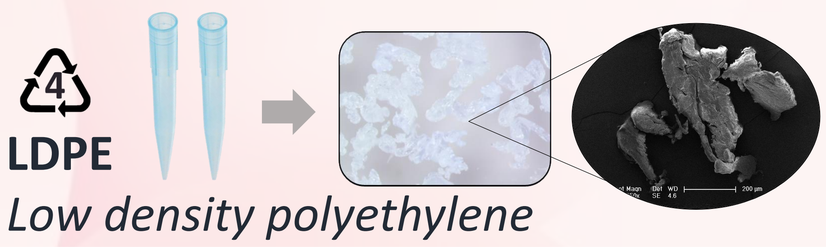
1 PET *Polyethylene terephthalate*



2 HDPE *High density polyethylene*

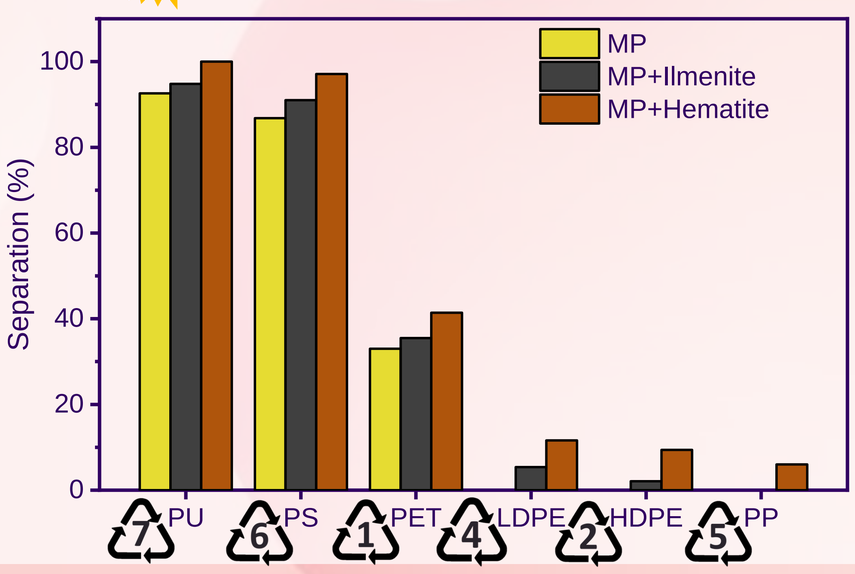


4 LDPE *Low density polyethylene*



Effect of microplastic and mineral nature

MPs 100 – 250 μm



MP + **Mineral** = **Separation**

Hematite

A ~10% increase in separation regardless MP nature

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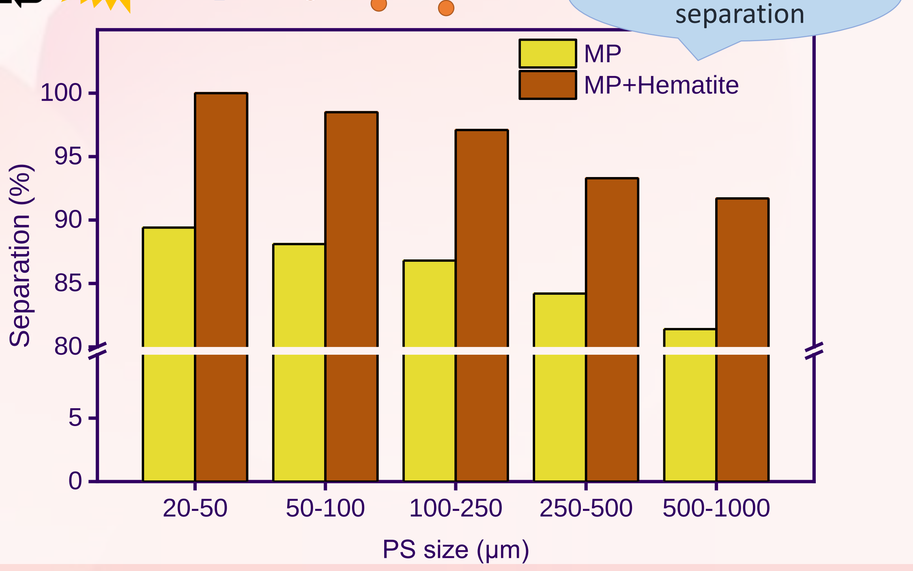
Ilmenite

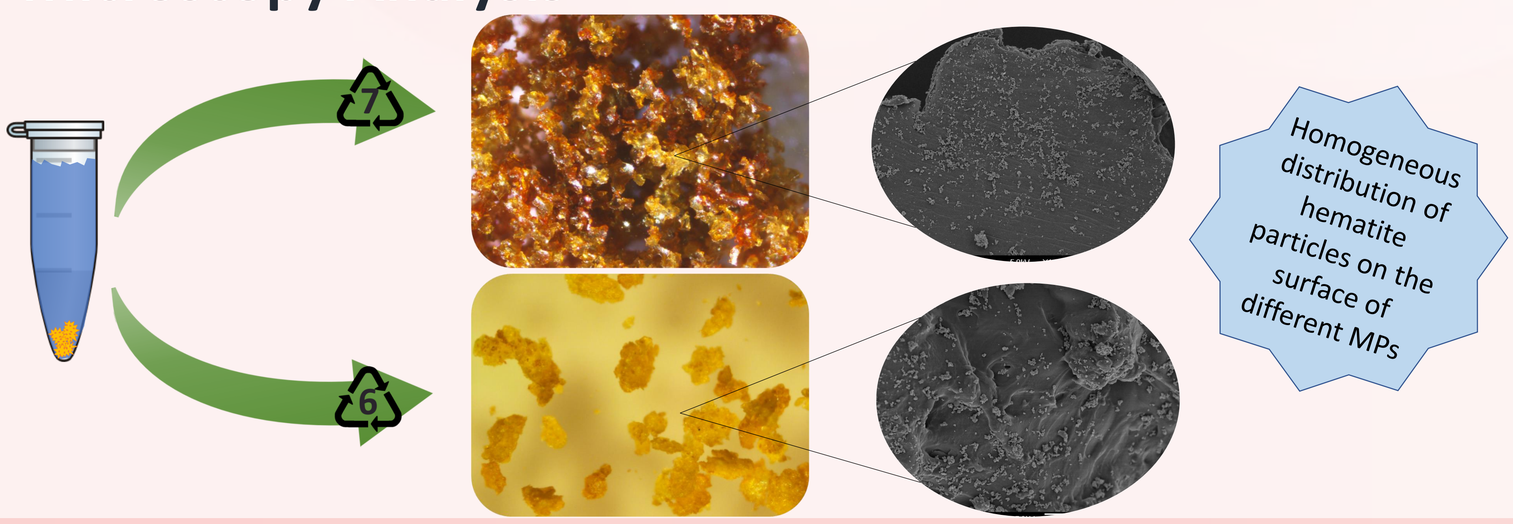
A ~5% increase in separation regardless MP nature

Effect of microplastic size

6 **PS** + **Hematite**



Microscopy Analysis



Conclusions

- The **adhesion of high density mineral powders onto MPs surface** allows to **increase their density** and **facilitates their separation** by sedimentation.
- **Regardless of the MPs nature**, their **separation is improved by** the adhesion of **mineral powders**.
- **Hematite** led to a **higher separation of MPs than ilmenite**.

References:

[1] Alimi et al., Environ. Sci. Technol. 52 (2018) 1704.

[2] Schmidt et al., Environ. Sci. Technol. 51 (2017) 12246.

Acknowledgements:

This research has been supported by the Autonoma University of Madrid and Community of Madrid through the project SI1-PJI-2019-00006, and by the Spanish MINECO through the project PID2019-105079RB-I00. M. Munoz thanks the Spanish MINECO for the Ramón y Cajal contract (RYC-2016-20648). D. Ortiz thanks the Spanish MIU for the FPU predoctoral grant (FPU19/04816).