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# Eco-Treatment of Microplastics: Laccase Enzyme based biodegradation

P.PORTO

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#### **INTRODUCTION & AIM**

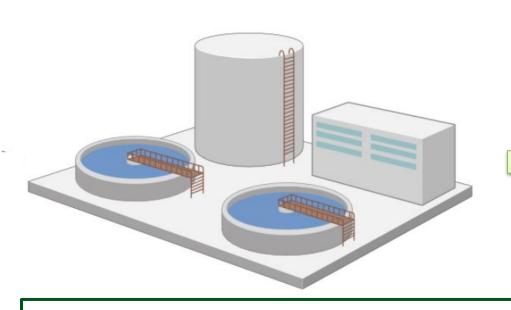
Microplastics (MPs) are defined as plastic particles smaller than 5 mm [1]

Primary MPs intentionally manufactured for commercial purpose [1]

Secondary MPs formed by the physical breakdown of larger plastic products in the environment [1]



Continued release of MPs poses a global threat to ecosystems and human health [1]



The Revised EU Urban Wastewater

Treatment Directive highlights the need to reduce the release of target micropollutants, including MPs, into the environment [2]

Development of **quaternary treatments** [2]

Biodegradation processes [3]

✓ Eco-friendly✓ Sustainable approach

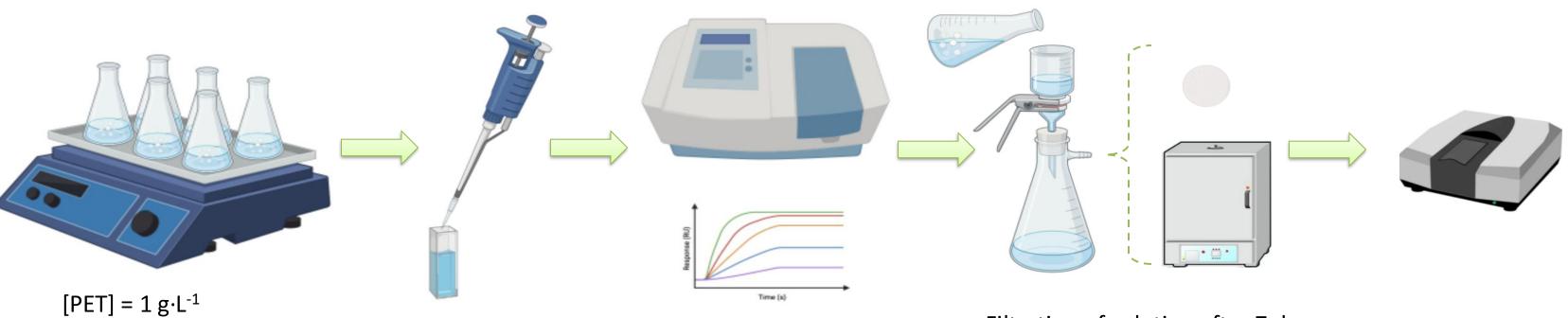
The aim of this study was to evaluate the effect of Laccase on the degradation of MPs.

✓ Three MPs were tested:

Low-density polyethylene (LDPE, 300 and 600 μm), Polyethylene terephthalate (PET, 300 μm), and Polyamide nylon 6 (PA6, 20 μm)

✓ Laccase from *Trametes versicolor* was used

## **METHOD**



[PET] =  $1 \text{ g} \cdot \text{L}^{-1}$ [Laccase] =  $50 - 200 \text{ U} \cdot \text{L}^{-1}$ 7 days contact time Monitoring twice a day

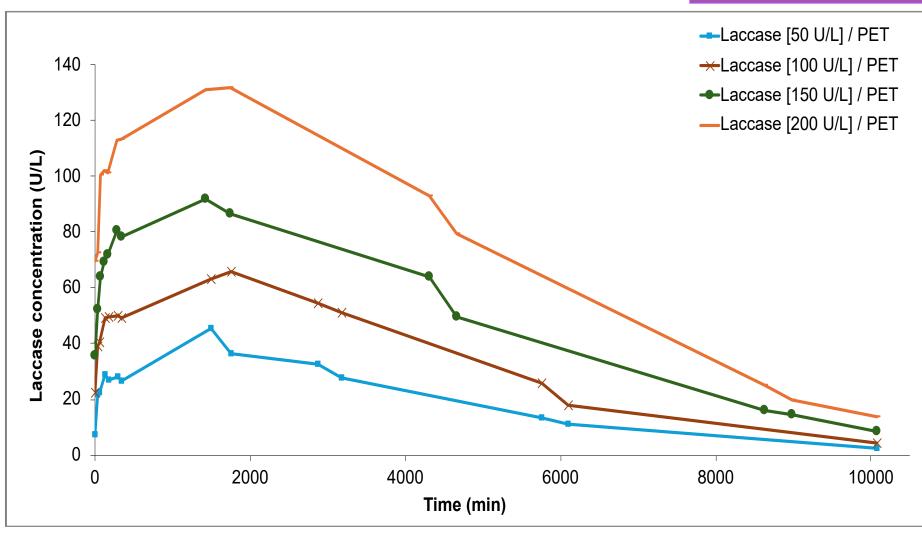
ABTS oxidation method

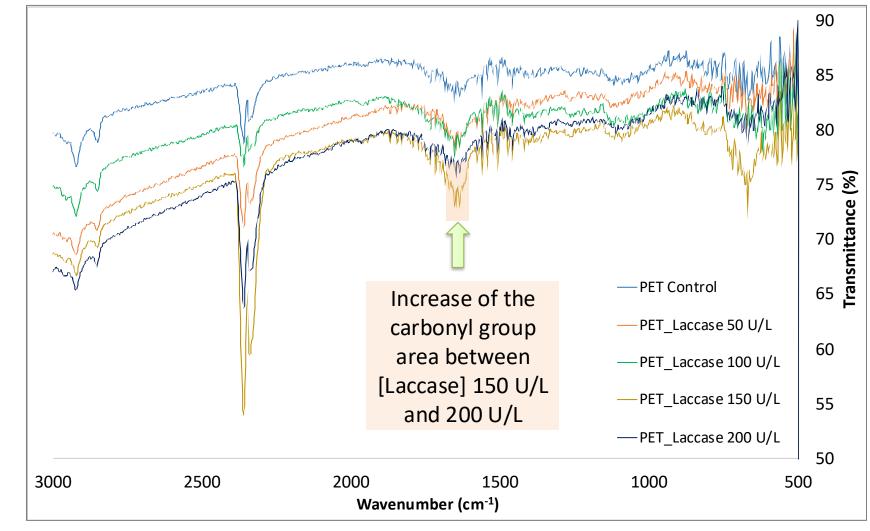
UV-VIS spectrophotometer Absorbance at 420 nm Filtration of solution after 7 days (glass fiber filter 1.2 μm of porosity)

Dried at 55 °C

FTIR analysis

## **RESULTS & DISCUSSION**





- ✓ After an initial increase, the Laccase activity declined over the 7-day experiment. The increase in Laccase initial concentration resulted in a visible enhancement in sedimentation of MPs, suggesting potential surface modifications that promoted their aggregation.
- ✓ FTIR analysis indicates minor spectral variations .

#### **CONCLUSION & FUTURE WORK**

- ✓ Studies using the enzyme Laccase indicated the breaking of polymer bonds, potentially contributing to the removal of MPs, and their persistence.
- ✓ Further research and optimization are essential to improve enzyme action and enhance polymer biodegradation.

#### **REFERENCES**

[1] Martinho, S.D. et al. (2022) Int. J.Environ. Res. Public Health. 19,5610[2] Directive (EU) 2024/3019 of the European Parliament and of the Council of 27 November 2024 concerning urban wastewater treatment (recast)

[3] Ramamurthy, et al (2024) Int J. Biol Macromol. 243, 133971









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