BIOCHEMICAL AND BEHAVIORAL EFFECTS INDUCED BY CONVENTIONAL AND BIO-DEGRADABLE PLASTICS TOWARDS THE CLADOCERAN *Daphnia magna*

Beatrice De Felice*[1], Stefano Gazzotti[2], Sophia Grew[1], Lorenzo Forzanini[1], Marco Aldo Ortenzi[2], Marco Parolini[1]

[1] University of Milan, Department of Environmental Science and Policy, Via Celoria 26, I-20133 Milan, Italy

[2] Laboratory of Materials and Polymers (LaMPo), Department of Chemistry, University of Milan, via Golgi 19, I-20133, Milan, Italy

*e-mail: beatrice.defelice@unimi.it

STUDY AIMS

This study aimed at investigating the potential toxicity induced by the exposure to microplastics (MPs) made of a conventional **fossil-based** polymer, the polyethylene terephthalate (PET-MPs) and a **bioplastic**, the polylactic acid (PLA-MPs), towards the cladoceran *Daphnia magna* at different level of the biological hierarchy. The effect of PET-MPs and PLA-MPs exposure was investigated at sub-individual (i.e., biochemical) and individual (swimming behavior) level over a 21-day exposure.

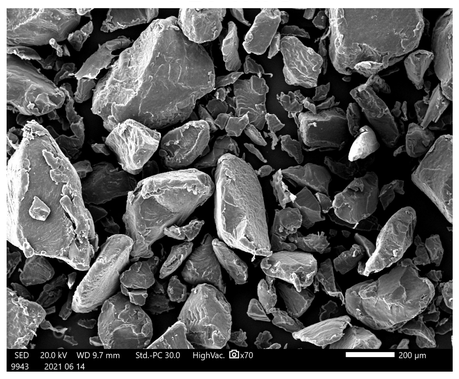
PET VS PLA

PET and PLA were chosen since they are the fossi-based polymer and the bioplastic more commonly used in food packaging. Indeed, in the transition from the use of fossil-based plastics to bioplastics PLA can be seen as the substitute of PET.

MATERIALS AND METHODS

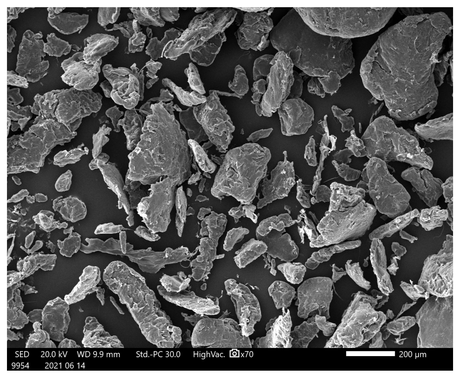
Three concentrations: **0.125 µg/mL**, **1.25 µg/mL**, **12.5 µg/mL** of irregular shaped PET-MPs and PLA-MPs were administered to cladocerans for 7, 14 and 21 days.

PET-MPs



Area (µm²): 19081.524 ± 1639.924
Circularity: 0.733 ± 2.577×10⁻²

PLA-MPs



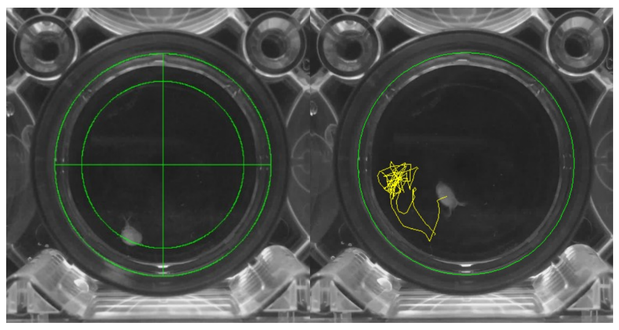
Area (µm²): 7066.880 ± 0.362
Circularity: 0.311 ± 5.392×10⁻⁶

SUB-INDIVIDUAL

- **Oxidative stress biomarkers**:
  - ✓ activity of antioxidant (CAT and GPx) and detoxifying (GST) enzymes
  - ✓ oxidative damage (lipid peroxidation)
- **Energetic biomarkers**:
  - ✓ content of protein, carbohydrate and lipid content
  - ✓ total caloric content

INDIVIDUAL

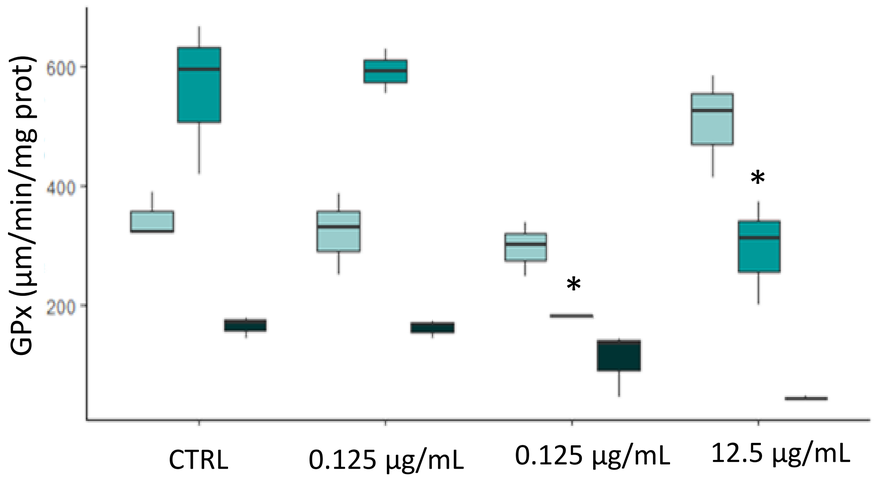
- **Swimming activity**:
  - ✓ swimming distance (mm)
  - ✓ swimming speed (cm/sec)



PET-MPs RESULTS

7 days 14 days 21 days

OXIDATIVE STRESS



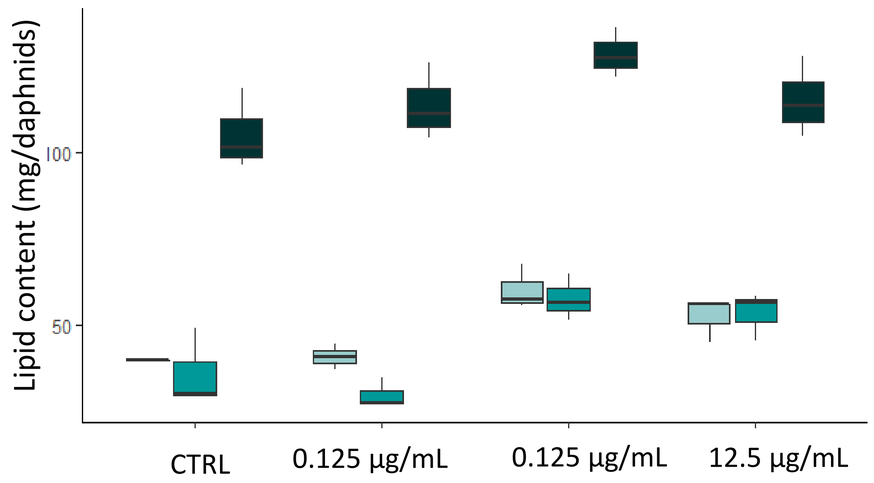
✓Effects on GPx

X No effects on CAT, GST and LPO

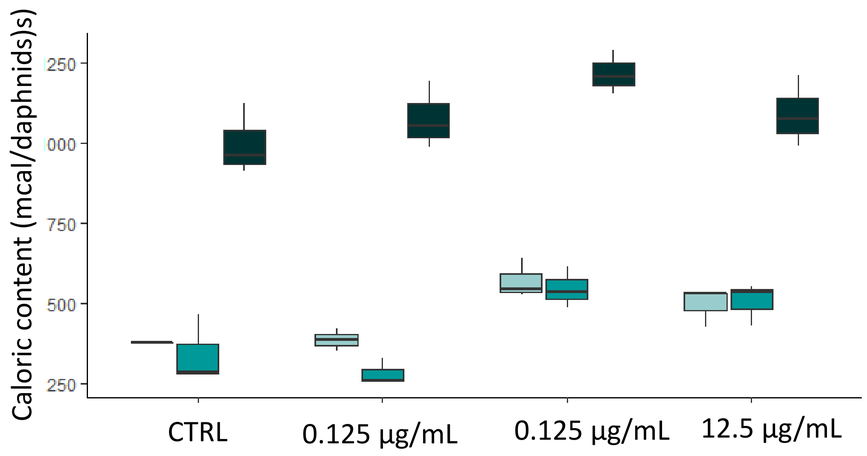
ENERGY

✓Effects lipids

X No effects on proteins and carbohydrates content



✓Effects on caloric content



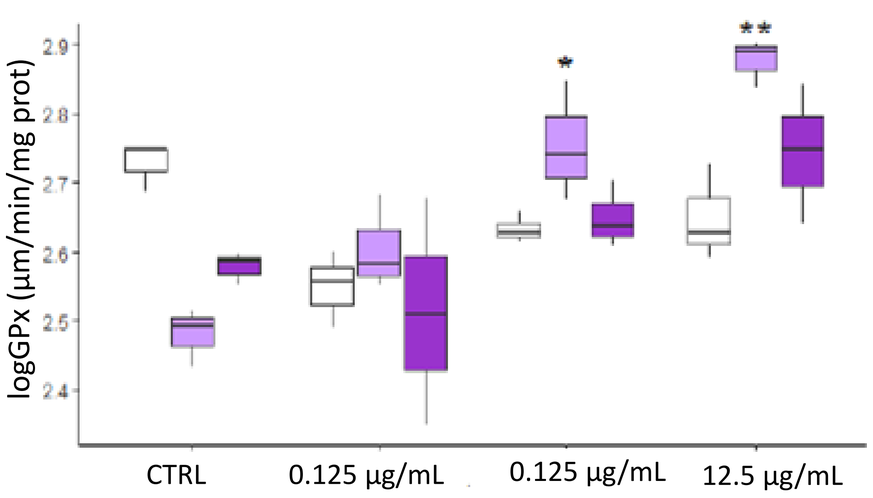
SWIMMING ACTIVITY

X No effects on swimming distance and swimming speed

PLA-MPs RESULTS

7 days 14 days 21 days

OXIDATIVE STRESS



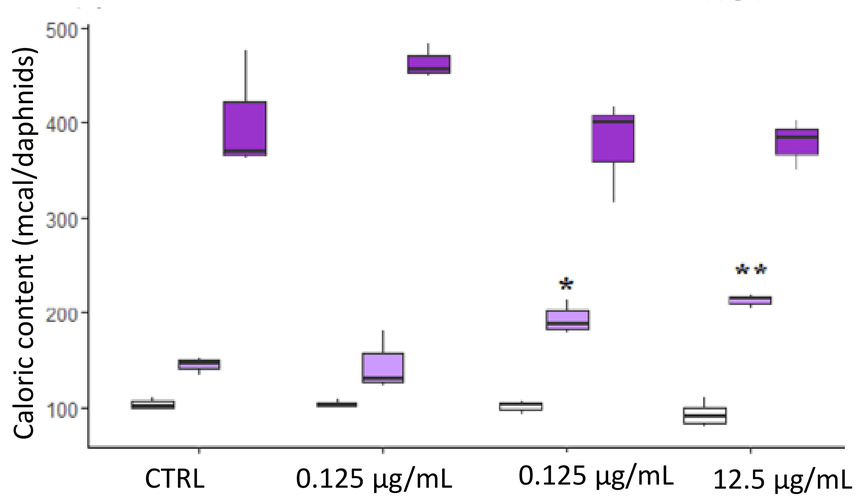
✓Effects on GPx and GST

X No effects on CAT and LPO

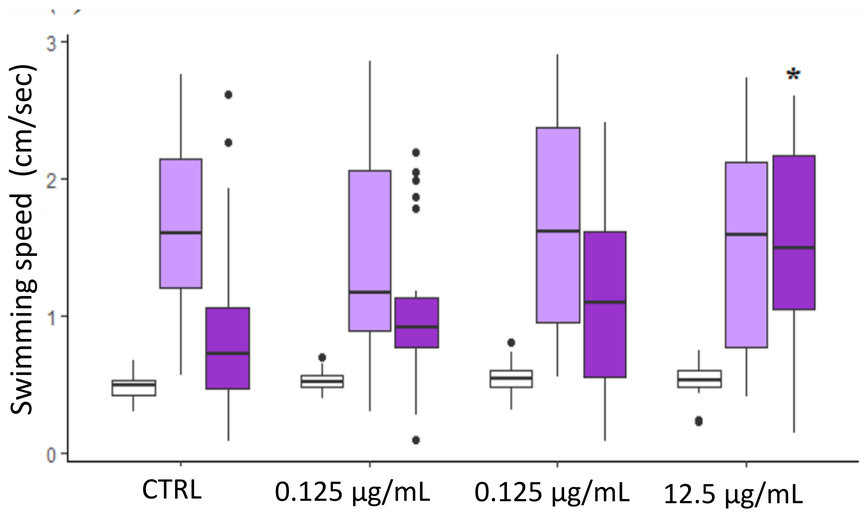
ENERGY

✓Effects on caloric content

X No effects on proteins, carbohydrates and lipid contents



SWIMMING ACTIVITY



X No effects on swimming distance

✓ Effects on swimming speed

CONCLUSIONS

These results suggested that both PET-MPs and PLA-MPs can affect the health status of a freshwater filter-feeder species. Surprisingly, the bioplastics appear to me more toxic than its fossil-based counterpart, representing a potential threat for freshwater ecosystems.