Adverse effects induced by micronized polyethylene terephthalate microparticles (PET-µPs) to the Manila clam (*Ruditapes philippinarum*)

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BACKGROUND

Microplastic (µPs) contamination represents a worrisome environmental issue threatening marine ecosystems. Recently µPs have been found also in bottom sediments and because of its high density compared to the seawater, µPs made by polyethylene terephthalate (PET) are the most abundant plastic-type found in deep sediments worldwide.

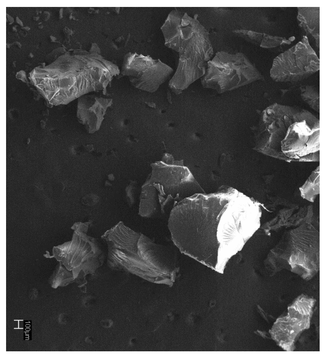
STUDY AIM

This study was aimed at investigating if a benthic organisms, such as the Manila clam (*Ruditapes philippinarum)*, might be affected by a 7 days exposure to two concentrations (0.125 and 12.5 µg/mL)of PET-µPs microplastic.

MATERIALS AND METHODS

Exposure conditions:

- **7 days** exposure**;**
- **irregular shaped PET-µPs** (size range 8 - 1,054 µm in length; mean length 220 µm);
- two doses**: 0.125 µg/mL** and **12.5 µg/mL**
- aerator to guarantee the **resuspension of PET-µPs** (PET density = 1.38 g/cm³)



*In order to confirm the µPs uptake an additional 1-day exposure to a highest, unrealistic PET- µPs concentration (50 µg/mL) was performed.

Performed analyses:

HISTOLOGICAL ANALYSES
(fixation in Bouin solution).

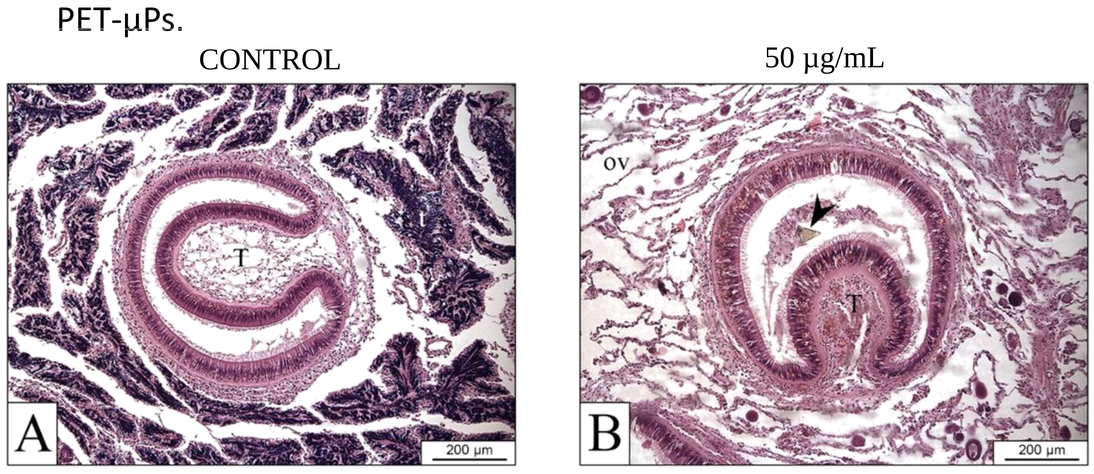
- **capability to ingest** PET-µPs
- the potential **tissues damage**

OXIDATIVE STRESS BIOMARKERS
(gills and digestive gland)

- modulation of **oxidative status** (ROS, SOD, CAT, GPx, GST)
- presence of **oxidative damage** (LPO)

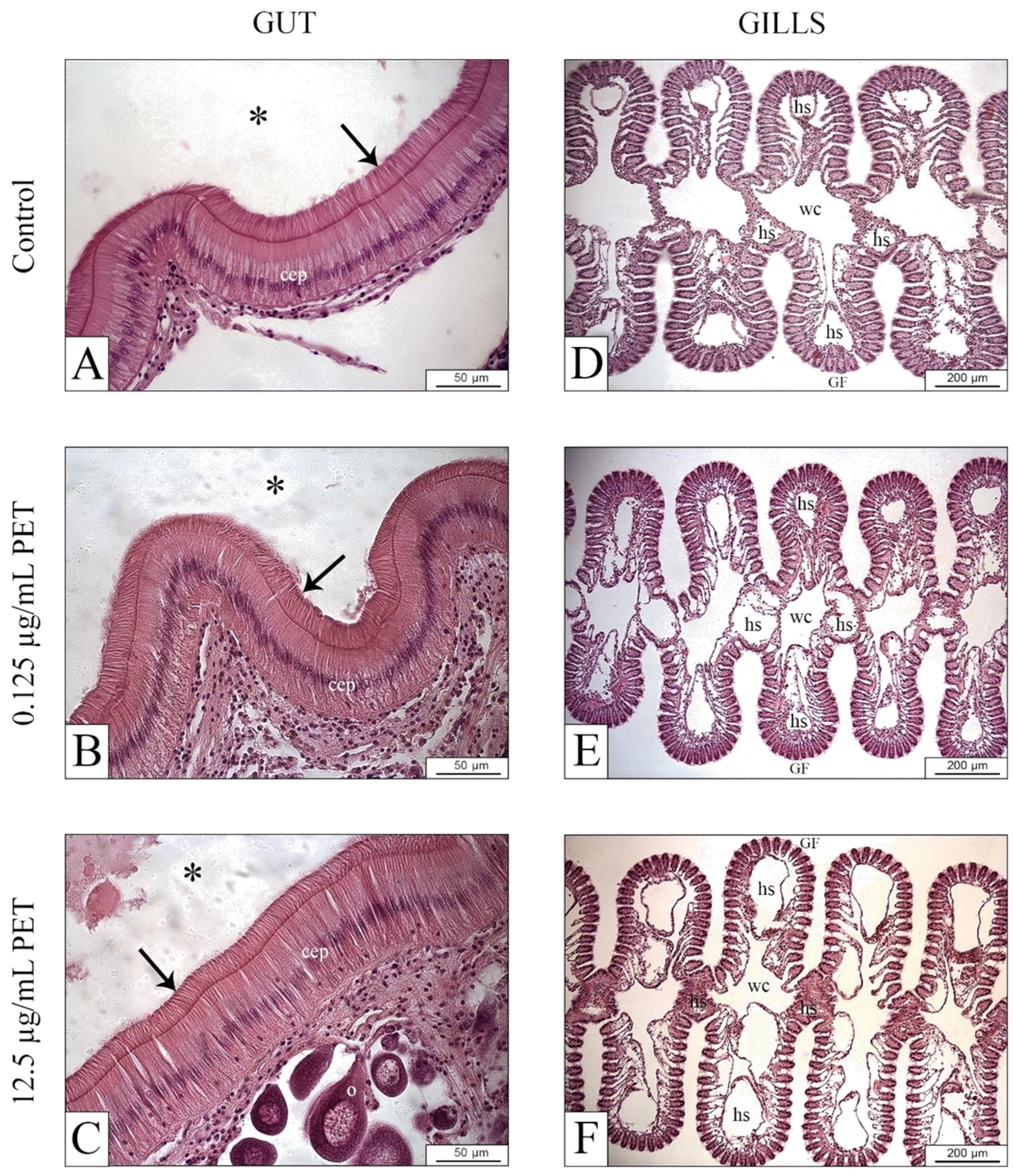
HISTOLOGICAL ANALYSES

The capability to ingest PET-µPs was confirmed by the exposure to 50 µg/mL (black arrow). Manila clams were able to efficiently ingest PET-µPs.



T = typhosole; ov = ovary

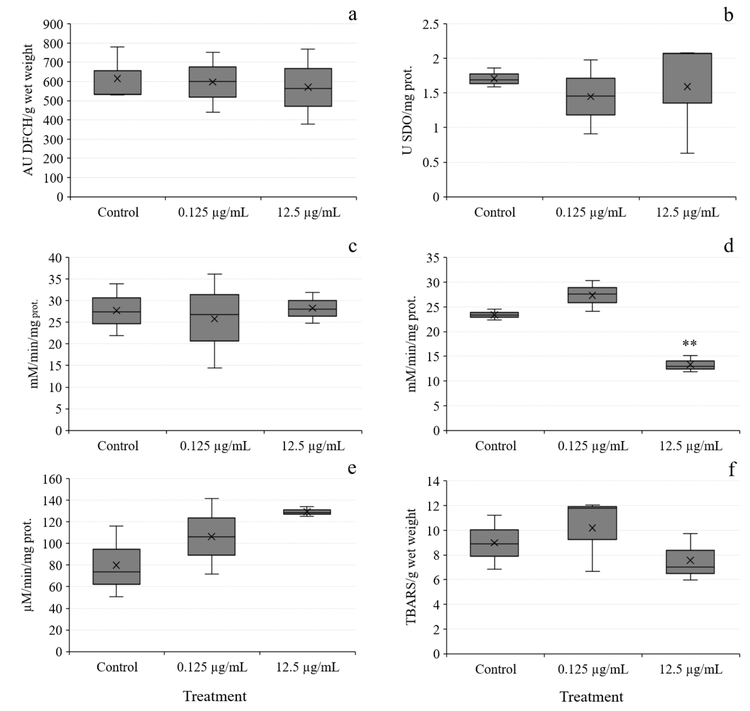
Although, the ingestion of PET-µPs no marked alterations of histological structure of the digestive tract walls or the gills structure were noted.



* = lumen; → = bristle-like cilia; cep = columnar epithelium; o = oocyte; GF = gill filament; wc = water channel; hs = haemal sinus.

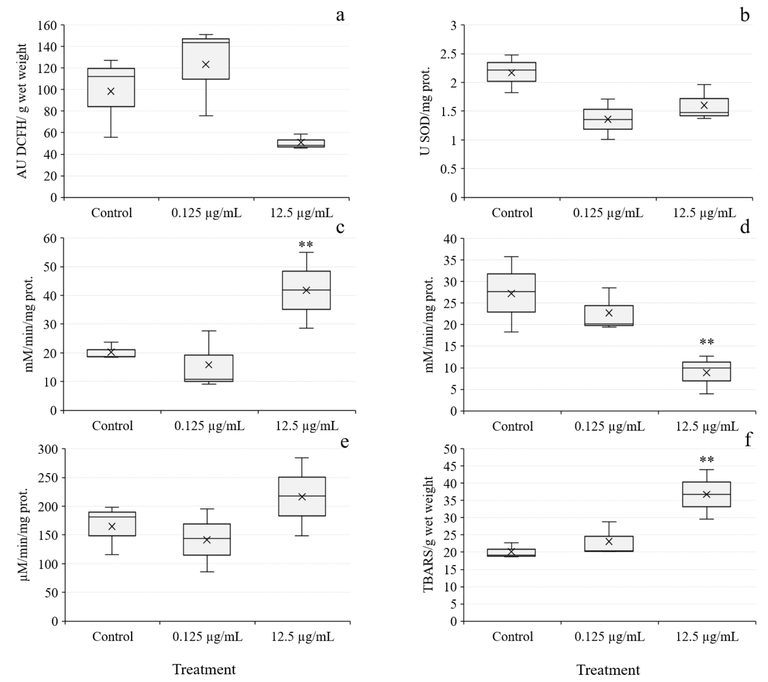
OXIDATIVE STRESS BIOMARKERS

Box and whiskers plot of the ROS (a), activity of SOD (b), CAT (c), GPx (d), GST (e) and LPO levels (f). The '×' symbol within the box-plots represents the mean of values, while asterisks above the box-plots show significant differences in the biomarker response between treated and control group (** $p < 0.01$).



DIGESTIVE GLAND

The exposure to both the concentration in analysis failed to induce oxidative stress in the digestive gland, as overproduction of pro-oxidants or modulation of antioxidant responses and GST, with the exception of a significant inhibition of GPx, or a change in the levels of lipid peroxidation were observed



GILLS

The exposure to 12.5 µg/mL PET-µPs produced a **modulation in oxidative status**, as evidenced by significant increase in CAT and inhibition of GPx activity.

The significant increase in lipid peroxidation levels observed in clam gills at the end of the exposure to 12.5 µg/mL PET-µPs suggest that the exposure might induce **oxidative damage to lipids**.

CONCLUSIONS

- **NO** mortality
- **YES** ingestion
- **NO** histological effects
- **YES** oxidative stress on gills
- **NO** oxidative stress on digestive gland

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