Toxicity of a Multi-Polymer Microplastic Mixture on *Mytilus edulis*

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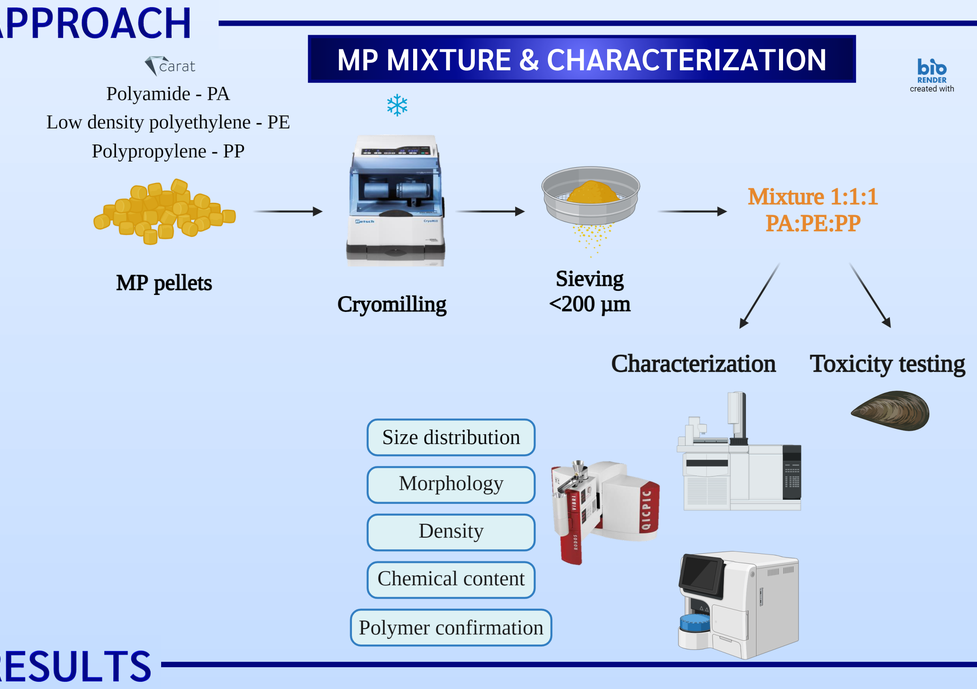
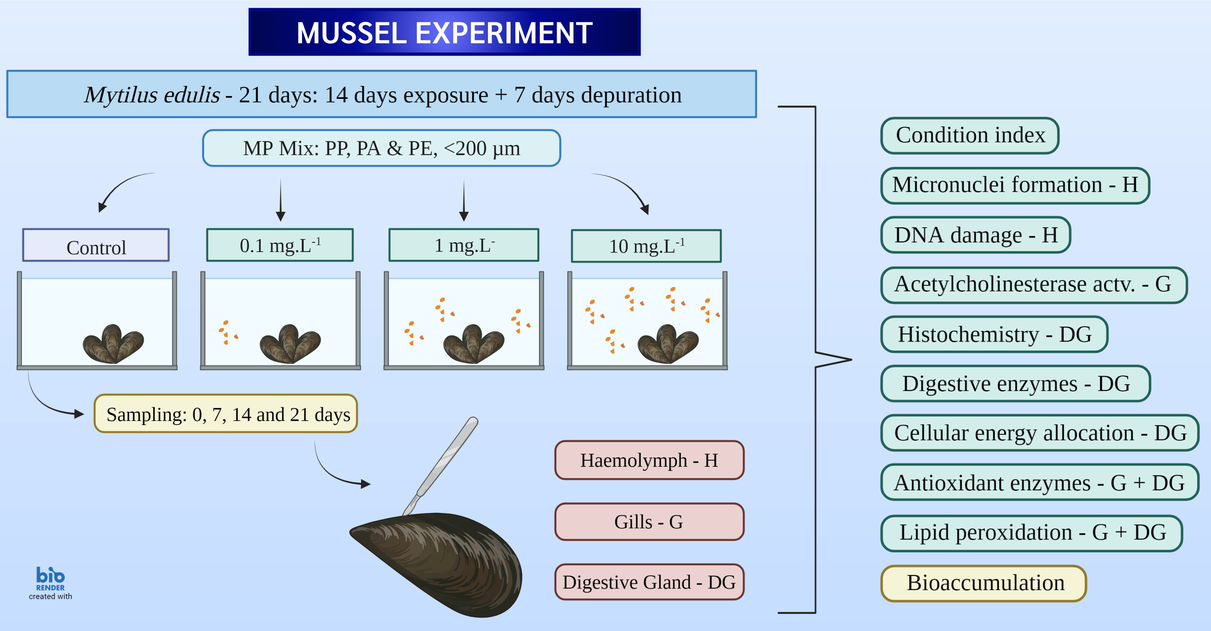
BACKGROUND

Microplastic (MP) pollution in marine environments is a topic of emerging concern. Due to their ubiquity and small size, plastic particles are easily taken up by marine organisms, causing adverse biological responses. Research so far has focused primarily on the impacts on organisms by pristine test materials that are often spherical and single polymer made. However, plastics found in the environment are mainly a mixture of different polymers with varying sizes and shapes, which raises questions about their combined impacts in marine organisms. Mussels *Mytilus sp.* are widely acknowledged bioindicators in ecotoxicological and biomonitoring studies for evaluating the health status of aquatic ecosystems, mostly due to their wide distribution, filter-feeding ability, sessile behavior, and ecological and commercial importance. Accordingly, the main objective of this study was to investigate the accumulation and toxicity of a MP mixture of relevant polymers (polypropylene, polyamide and polyethylene, <200 µm) at three concentrations (0.1 mg.L^{-1}, 1 mg.L^{-1} and 10 mg.L^{-1}) in the mussel *Mytilus edulis* over a three-week exposure experiment (14 days exposure and 7 days depuration).

APPROACH





RESULTS

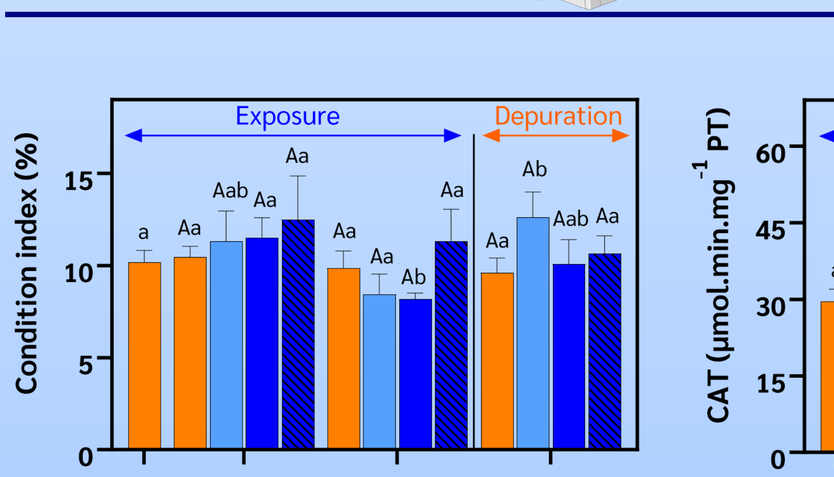


Figure 1 – Condition index, catalase (CAT) and glutathione s-transferase (GST) in digestive glands of mussels *Mytilus edulis* exposed to the MP mix (PP, PA and PE) for 21 days. Capital letters represent statistical differences between treatments for each time point and lower letters for each treatment during the exposure duration (p<0.05).

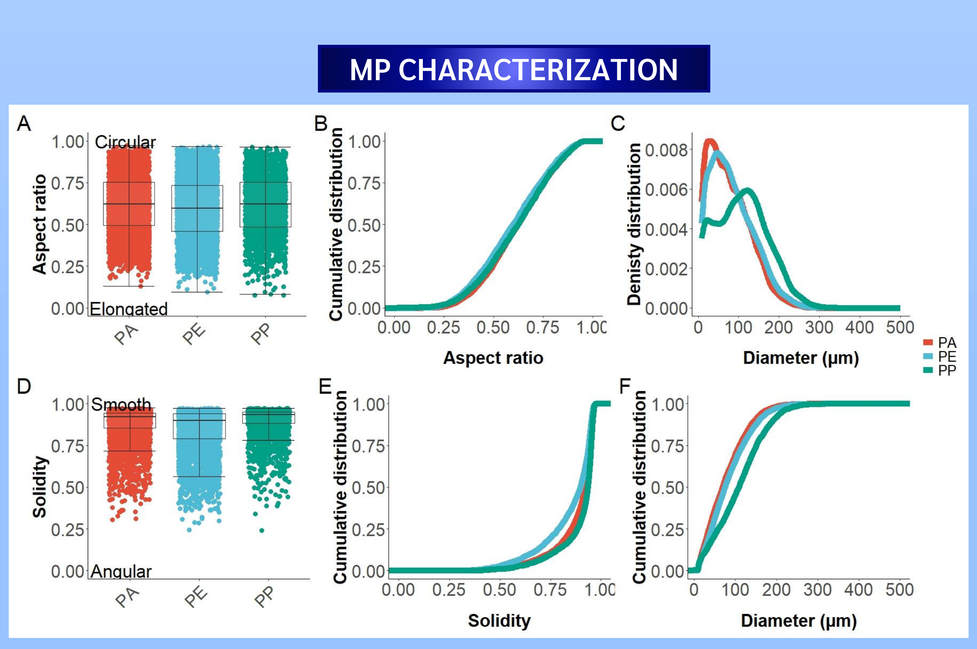


Figure 2 – Morphology and density distribution of PA, PE and PP using dynamic image analysis (DIA).

MAIN FINDINGS

- **Particle characterization:**
  - MPs ranged from 9 – 327 µm in diameter ➔ PA & PE with lower diameter range.
  - PE most elongated and angular MP.
- **Mussel responses to MP mix:**
  - **Condition index** ➔ Slight decrease at 0.1 and 1 mg.L^{-1} after 14 days exposure, followed by a recovery after depuration ➔ Signs of reduced feeding due to particle ingestion?
  - **CAT activity** ➔ Concentration dependent increase following exposure ➔ activation of the antioxidant defense system in the digestive gland due to the formation of ROS.
  - **GST activity** ➔ Slight increase at 1 and 10 mg.L^{-1} at 7 days, as well as after the depuration period ➔ further indication of oxidative stress in the digestive gland.

CONCLUSIONS

- **Analyses are ongoing ➔ BUT!** indication of particle ingestion and oxidative stress in the digestive gland ➔ Envision that results will contribute to understanding the interactions between ≠ polymers in the environment and their potential toxic effects in organisms.
- Overall, this study will help assess the **toxicity thresholds** and establish **baseline hazard** knowledge for a **MP mixture** of environmentally relevant polymers ➔ support future **hazard and risk assessment of MPs** in **Norwegian ecosystems**.

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References: Revel et al. (2019). Frontiers in Environmental Science: 7(33); Beyer et al. (2017). Marine Environmental Research: 130; Sun et al. (2019). Scientific Reports: 9591.

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