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The Plymouth Student Scientist
University of Plymouth

Do microplastics affect the bioavailability of harmful pollutants?

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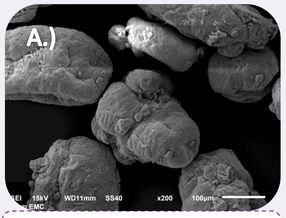
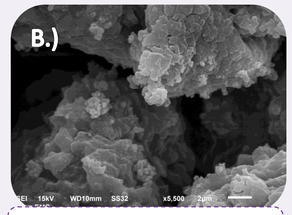


A.) PVC particles x200 magnification, see B.) for increased magnification.

RESEARCH HIGLIGHTS: ➤Microplastics pollution is ubiquitous in marine environments ➤The potential for microplastics to transfer pollutants into food chains is unknown ➤ Larval zebrafish were used as an analytical tool to assess bioavailability ➤ Microplastics reduced the bioavailability of phenanthrene in two exposures ➤ A novel method was developed to assess bioavailability of microplastic co-contaminants



B.) PVC particles x5,500 magnification, see A.) for decreased magnification.

INTRODUCTION:

Microplastic Definition = Pieces of plastic smaller than five millimetres (Arthur et al., 2009).

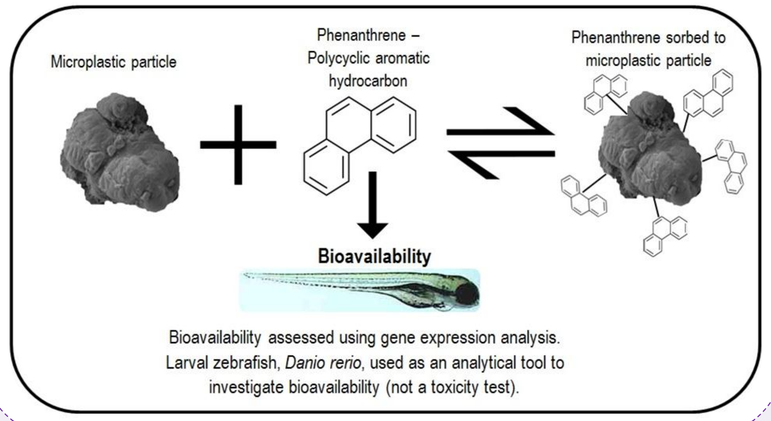
What we know ➤

- Millions of tonnes of plastic are produced every year (Browne et al., 2011)
- Microplastics are dispersed globally in the oceans (Thompson et al., 2004)
- Microplastics accumulate harmful toxic compounds (including phenanthrene), up to a million times more than sea water (Mato et al., 2001)
- Many marine organisms ingest microplastic at different trophic levels (Gregory, 2009)

What we don't know ➤

- If the harmful toxic compounds on the surface of microplastics go into the tissues of the organisms (bioavailability)

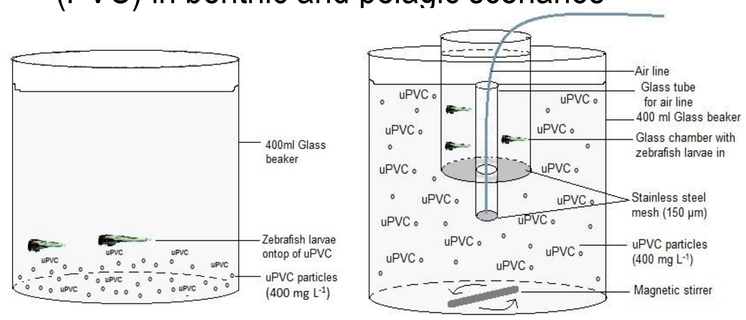
Research aims ➤



Bioavailability assessed using gene expression analysis. Larval zebrafish, *Danio rerio*, used as an analytical tool to investigate bioavailability (not a toxicity test).

METHOD:

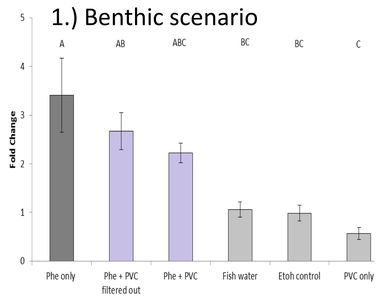
- Contaminate microplastic particles (200-250 µm) with Phenanthrene (Phe)
- Expose zebrafish larvae to contaminated plastic (PVC) in benthic and pelagic scenarios



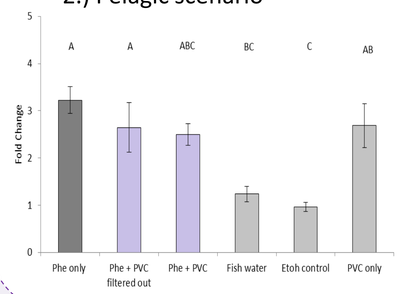
- Analyse *cyp1a* gene expression as a biomarker for bioavailability

RESULTS:

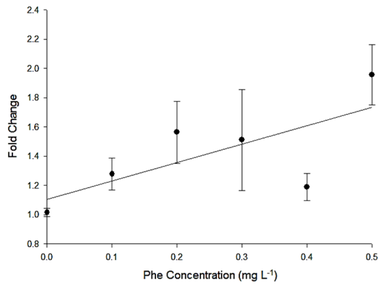
1.) Benthic scenario



2.) Pelagic scenario



3.) *cyp1a* expression to Phe conc. dose-response



1.) & 2.) Average fold change (± S.E, n=3) of *cyp1a* expression normalised with *β-actin*. Statistically significant differences (P<0.05) between factors indicated by superscript above error bar, means that do not share a letter are significantly different.

3.) Average fold change (± S.E., n=3) of *cyp1a* expression normalised with *β-actin*. Solid Line indicates statistically significant linear regression (P<0.05)

DISCUSSION:

- ➤ Phe induces *cyp1a* in concentrations of 0.1mg L^{-1} and above
- ➤ Using *cyp1a* as a biomarker of bioavailability, it was demonstrated that microplastics reduce the bioavailability of Phe in two ecological scenarios
- ➤ Overall it was shown that microplastics modify the bioavailability of co-contaminants, highlighting the need for further research into the ecological fate of sorbed pollutants
- ➤ The present study provides a novel and effective method for studying the bioavailability of microplastic co-contaminants

Acknowledgements:

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RESEARCH WITH PLYMOUTH UNIVERSITY

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