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Do microplastics affect the bioavailability of harmful pollutants?

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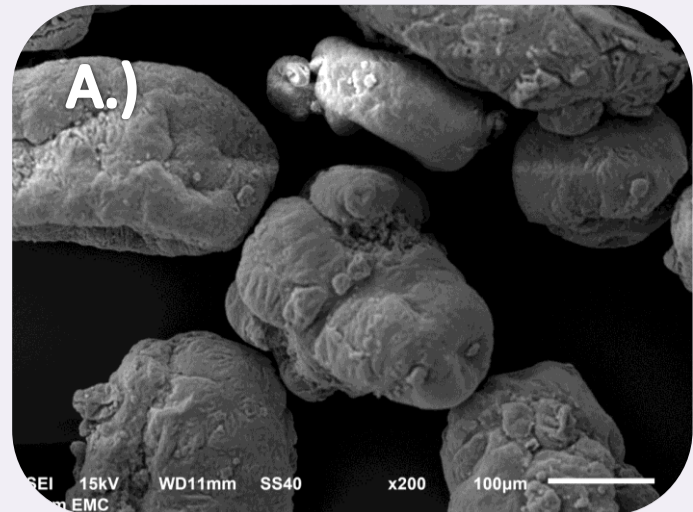
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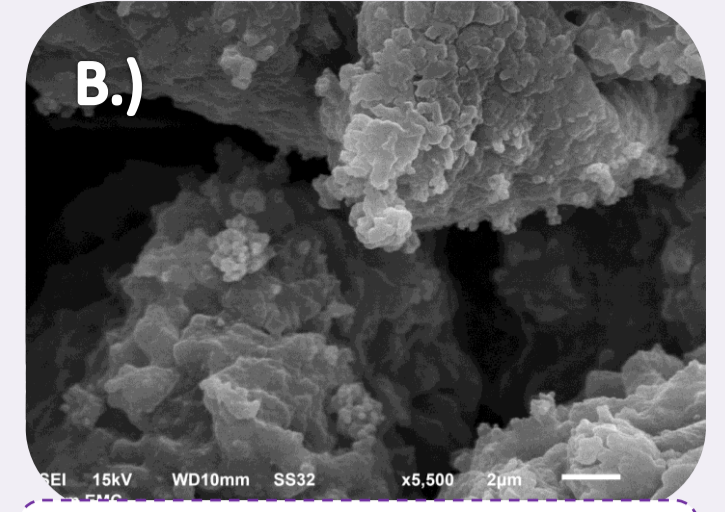
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Do microplastics affect the bioavailability of harmful pollutants?

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



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

RESEARCH HIGHLIGHTS: ➤ 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

INTRODUCTION:

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

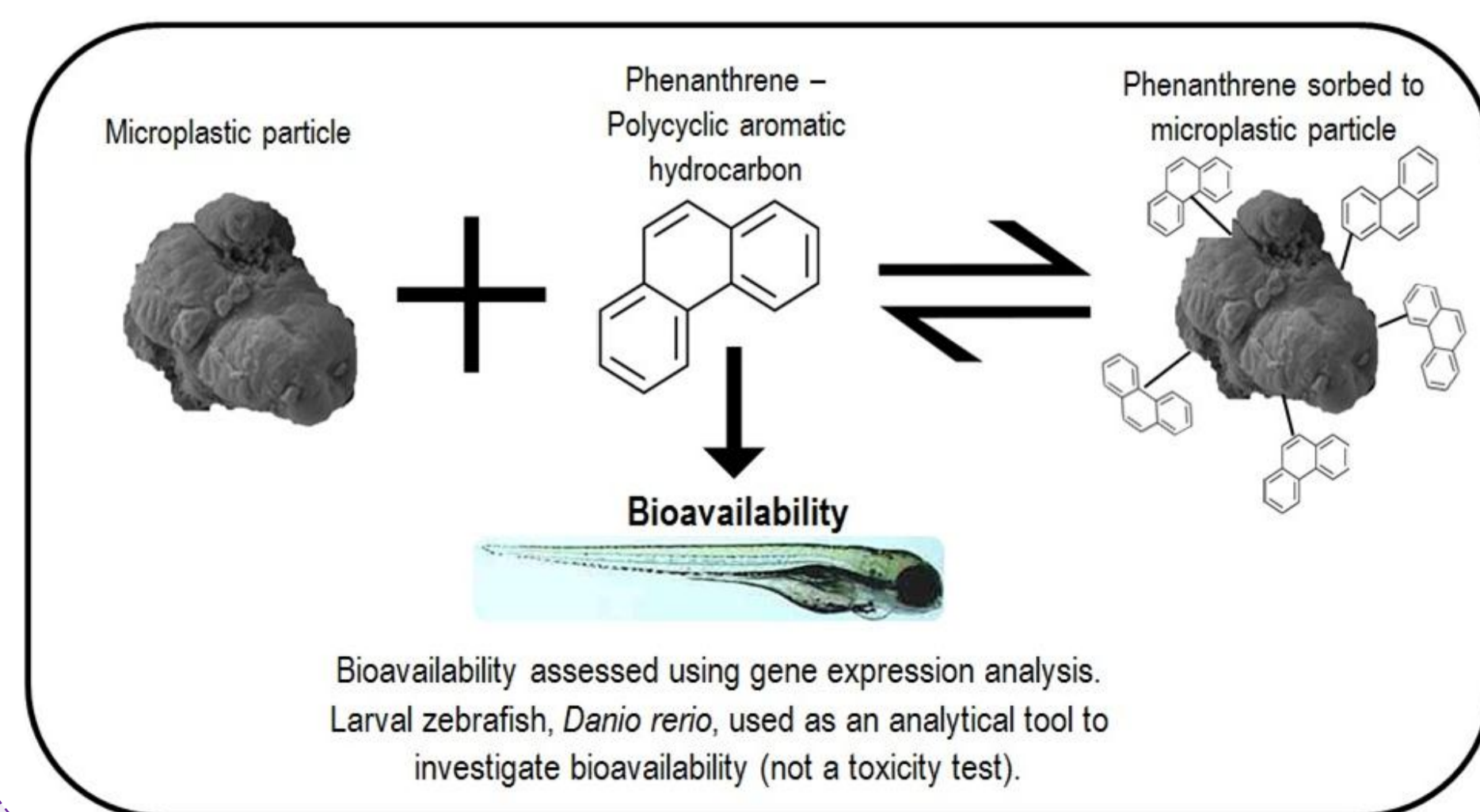
What we know ➤

- 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 ➤

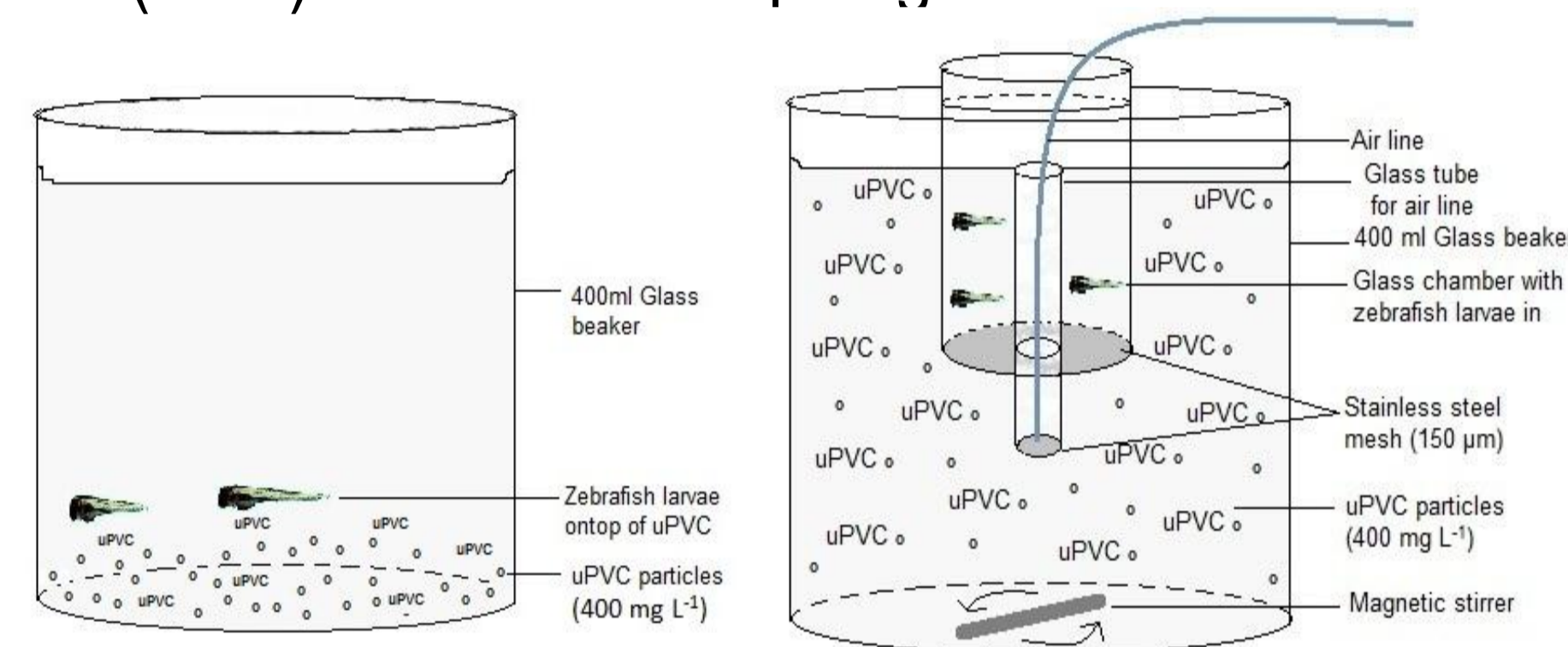
- If the harmful toxic compounds on the surface of microplastics go into the tissues of the organisms (bioavailability)

Research aims ➤



METHOD:

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

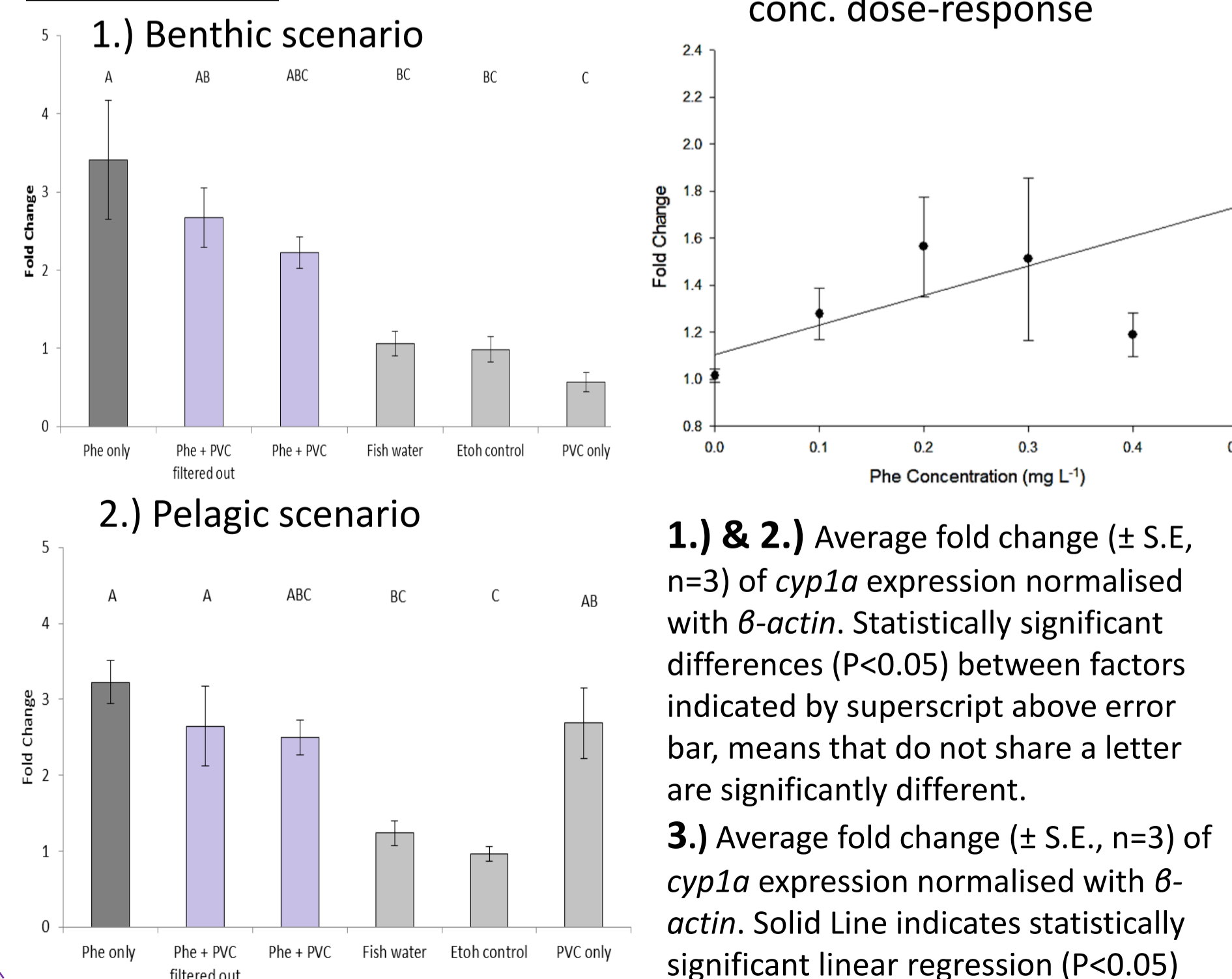


- Analyse *cyp1a* gene expression as a biomarker for bioavailability

DISCUSSION:

- Phe induces *cyp1a* in concentrations of 0.1 mg 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

RESULTS:



Acknowledgements:

Thank you Dr Adil Bakir for technical help with the sorption of Phe onto uPVC, Dr Helena Reinardy and Gabriella Martinez Aguirre for guidance with molecular techniques and Stan McMahon for provision of zebrafish embryos and help with rearing larvae. Thank you also to Prof Richard Thompson for general microplastic advice and finally thank you to Dr Ted Henry for continued guidance and support with all aspects of the project.

RESEARCH WITH PLYMOUTH UNIVERSITY

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