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Do microplastics affect the bioavailability of harmful pollutants?

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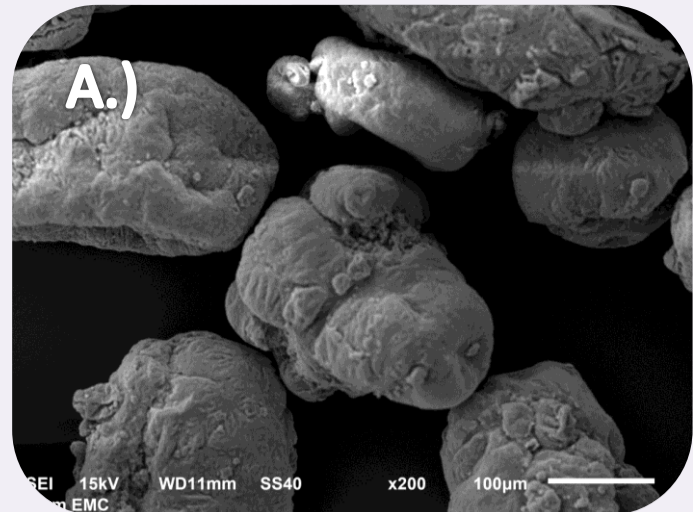
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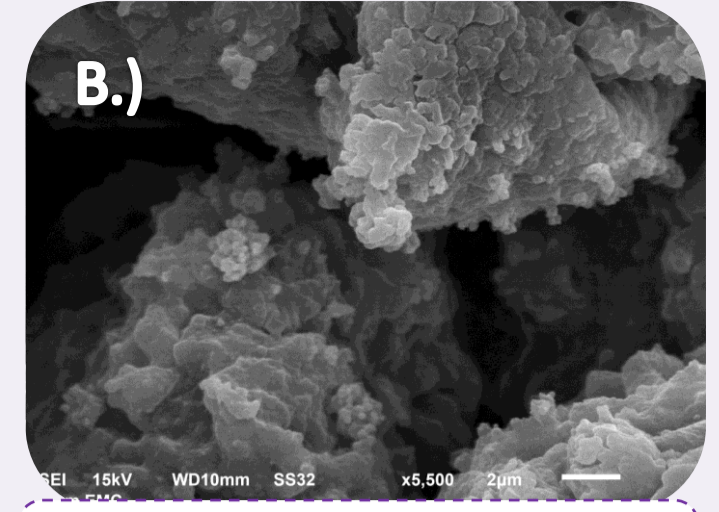
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Do microplastics affect the bioavailability of harmful pollutants?

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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).

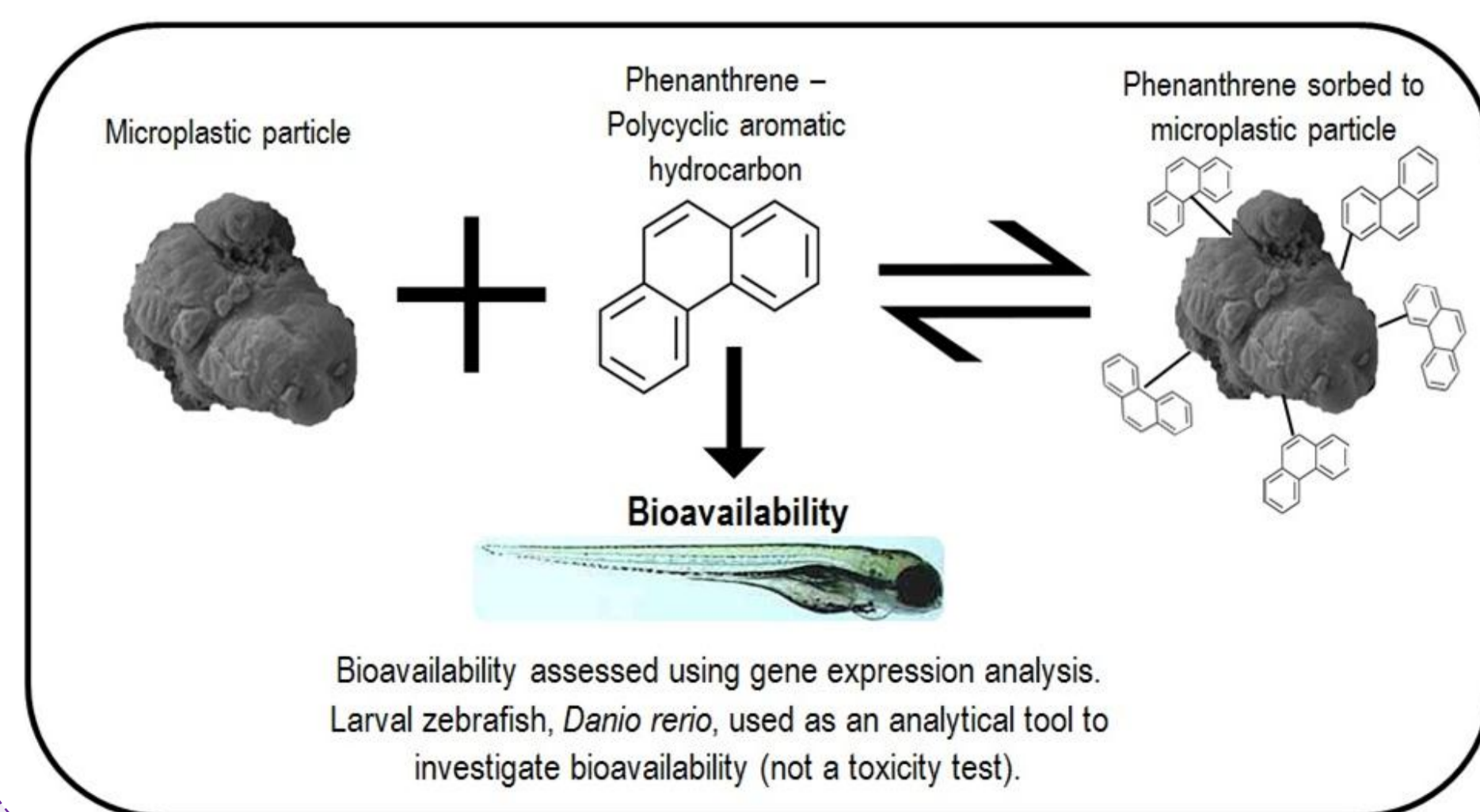
What we know ➤

- 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 ➤

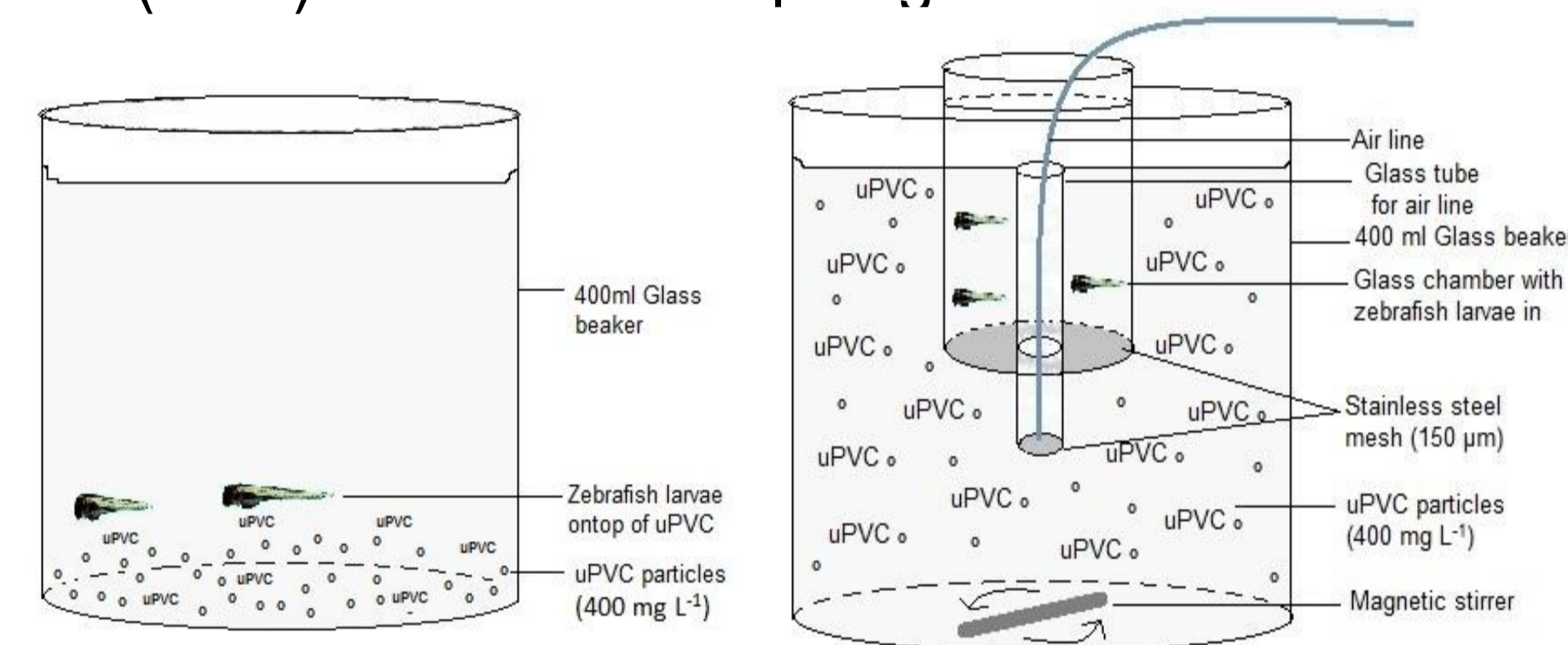
- If the harmful toxic compounds on the surface of microplastics go into the tissues of the organisms (bioavailability)

Research aims ➤



METHOD:

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

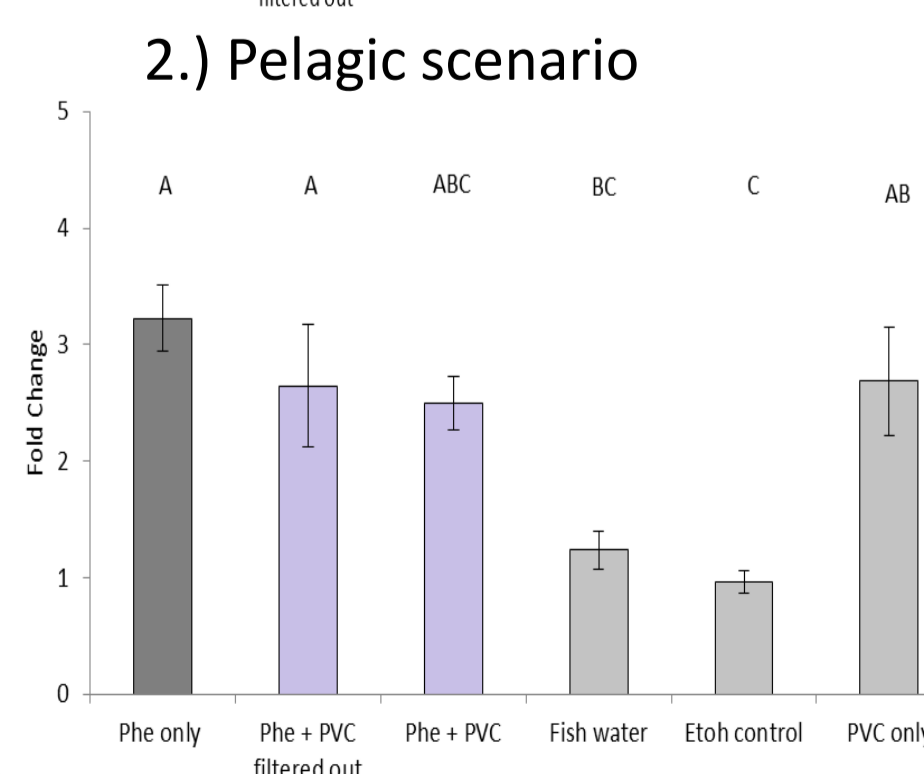
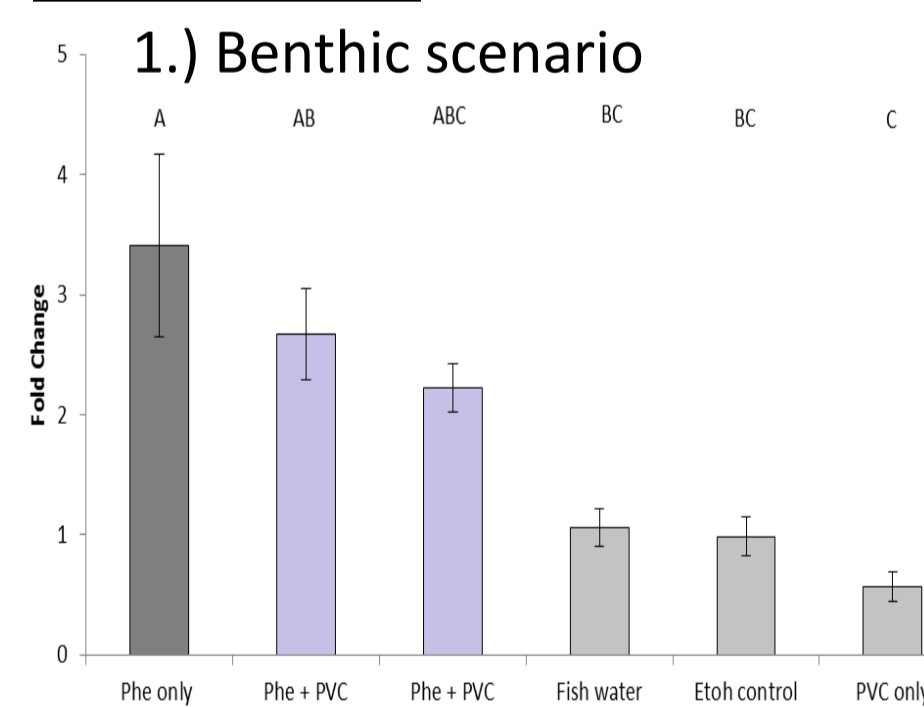


- Analyse *cyp1a* gene expression as a biomarker for bioavailability

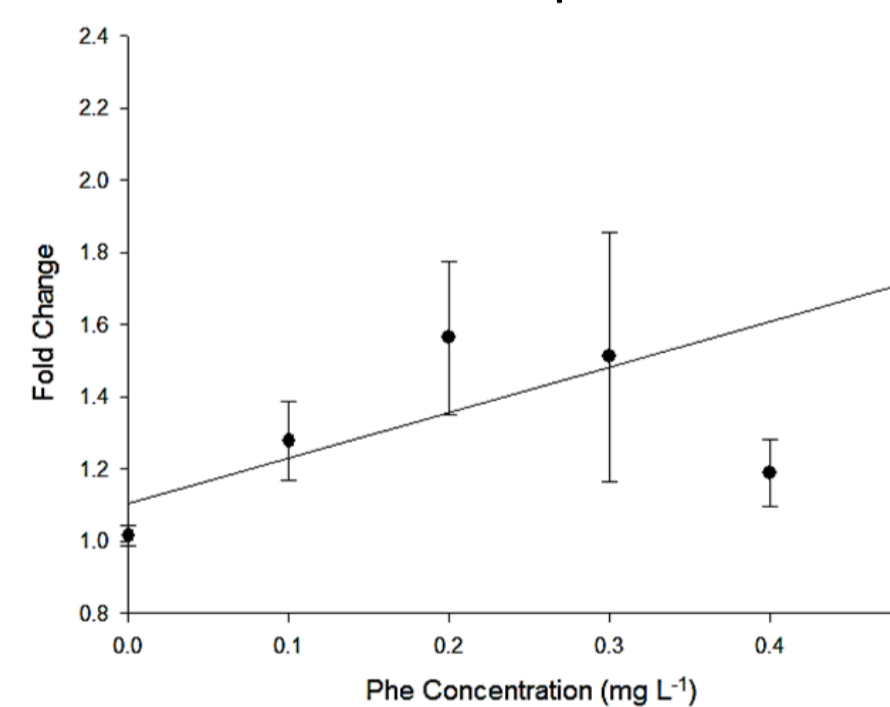
DISCUSSION:

- 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:



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



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

Acknowledgements:

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RESEARCH WITH PLYMOUTH UNIVERSITY

References:

Arthur, C., Baker, J., & Bamford, H. (2009). Proceedings of the International Research Workshop on the Occurrence, Effects and Fate of Micro-plastic Marine Debris Sept 9-11, 2008. NOAA Technical Memorandum. Browne, M. A., Crump, P., Niven, S. J., Teuten, E., Tonkin, A., Galloway, T., & Thompson, R. (2011). Accumulation of microplastic on shorelines worldwide: sources and sinks. *Environmental Science & Technology*, 45(21), 9175-9. Gregory, M. R. (2009). Environmental implications of plastic debris in marine settings—entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, 364(1526), 2013-25. Mato, Y., Isobe, T., Takada, H., Kanehiro, H., Ohtake, C., & Kaminuma, T. (2001). Plastic resin pellets as a transport medium for toxic chemicals in the marine environment. *Environmental Science & Technology*, 35(2), 318-324. Thompson, R. C., Olsen, Y., Mitchell, R. P., Davis, A., Rowland, S. J., John, A. W. G., McGonigle, D., et al. (2004). Lost at sea: Where is all the plastic? *Science*, 304(5672), 838.