2014

Do microplastics affect the bioavailability of harmful pollutants?

Sleight, V.

http://hdl.handle.net/10026.1/14061

All content in PEARL is protected by copyright law. Author manuscripts are made available in accordance with publisher policies. Please cite only the published version using the details provided on the item record or document. In the absence of an open licence (e.g. Creative Commons), permissions for further reuse of content should be sought from the publisher or author.
Do microplastics affect the bioavailability of harmful pollutants?

Vicky Sleight, Marine Biology B.Sc. (Hons), Plymouth University.

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 (Melo 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

RESULTS:
1.) Benthic scenario
2.) Pelagic scenario
3.) cyp1a expression to Phe conc. dose-response

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:
Thank you Dr Adil Ali for technical help with the sorption of Phe onto uPVC, Dr Helena Reinardy and Gabriella Martinex 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.

References: