Microplastic as a vector for micropollutants in aquatic environments

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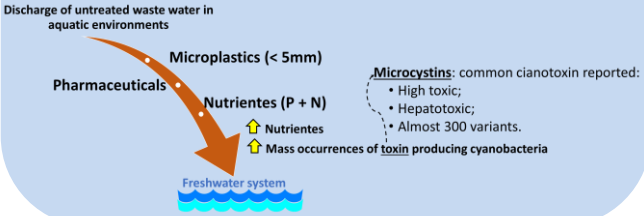
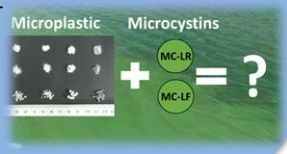
Introduction

Plastics have become an environmental issue. They can fragment gradually through physicochemical processes, leaving behind numerous plastic fragments, because of this, plastics can enter the aquatic environment in a wide range of sizes. All particles smaller than 5 mm are defined as microplastics. Microplastics may act as a vector for micropollutants present in fresh water systems, such as microcystins and pharmaceuticals into the food web.



Methods

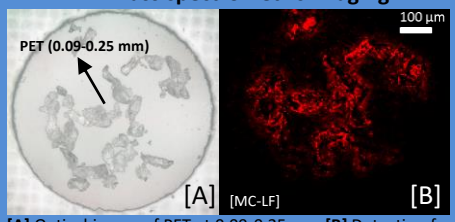
Based on environmental relevance microplastic types, microcystins and pharmaceuticals have been selected to evaluate the adsorption behaviour of these micropollutants. A proof-of-principle study was performed and the adsorption of two microcystin variants (MC-LR, most commonly reported and MC-LF, most hydrophobic) onto microplastics was elucidated. To this end, four microplastic types (PET, low density polyethylene, PVC, polystyrene) in three microplastic sizes were selected due to their world-wide use and reported Occurrence in freshwater. Further, the effect of the pH of the water was considered.



Results

The hydrophobicity of the microcystins, particle size, polymer type and pH affected adsorption onto the microplastics. Microcystin-LF showed the most adsorption on microplastics analysed (Fig 1). Microcystin-LR is commonly studied as the representative of all microcystins variants, it is, however, not possible to predict the behaviour of all microcystin variants by analysing the most common variant (MC-LR). While adsorption of most hydrophobic variant (MC-LF) onto several types of microplastics was demonstrated further investigation is necessary to fully elucidate the role of microplastics as vectors for natural and anthropogenic contaminants in freshwater systems.

MALDI mass spectrometric imaging



[A] Optical image of PET at 0.09-0.25 mm **[B]** Detectin of the Na aduct of MC-LF represented by the color red confirming microcystin presence on PET particles.
Acknowledment: Prof Chrisrine Edwards.

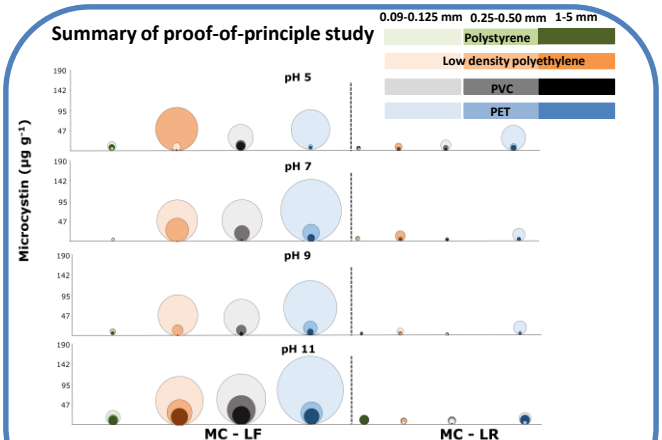


Fig 1 .The effect of particle size and pH conditions on the amount of microcystins-LR and –LF adsorbed onto four different microplastics after 48 h of exposure.

Future

Experiments to evaluate the adsorption behavior of others microcystin variants and pharmaceuticals, and to elucidate the factors affecting their desorption from microplastics will be performed. Further, toxicity studies with *Daphnia sp.* will be undertaken. Additionally, due to the importance quantify bound and unbound microcystins and pharmaceuticals onto microplastics when monitoring water, an assessment of published routine water sampling protocols will be carried out with the aim to develop a novel protocol that avoids the underestimation of these pollutants.

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