



Presence, fate and ecological effects of microplastics in the freshwater environment

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About me

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Microplastics – what are they?

Plastic particles <5mm, >1µm

Sources: -**Primary**: microbeads, glitter, industrial pellets (nurdles) -Secondary: Breakdown of large litter, microfibres

Beads/pellets



Fibres



Fragments



Microplastics - why study them?

Microplastics are everywhere!

Can be ingested by organisms

Can transport hazardous chemicals

Long-term fate and effects not well understood



Microplastic transport in the environment



Horton et al (2017) Science of the Total Environment Horton and Dixon (2018) WIRES Water





Microplastics in UK river sediment

Horton et al (2017). Marine Pollution Bulletin





Microplastics in UK river sediment

Spectroscopic analysis (Raman)





polymers

Inferred polymers (synthetic dye)

Other polymer

Horton et al (2017). Marine Pollution Bulletin

Microplastic ingestion by fish in the River Thames



Location	Distance downstream (km)
Cricklade	36
Castle Eaton	43
Sandford-Abingdon	106
Caversham-Sonning	162
Temple-Marlow	187
Shepperton-Sunbury	234
Sunbury-Molesey	239
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Horton et al (2018). Environmental Pollution





Fish ingestion analysis - results



Microplastics are ingested!

Polymers identified as: Polyethylene Polypropylene Polyester

fish S lastic microp ð Number



1. Size of fish

Horton et al (2018). Environmental Pollution

Microplastics and pesticides

Organism – Daphnia magna

72 hour exposures

Observations of:

- 1. Mortality
- 2. Swimming impairment

Deltamethrin

Pyrethroid insecticide High Log Kow (hydrophobic, insoluble)

Dimethoate Organophosphate insecticide Low Log Kow (hydrophilic, soluble)

Hypothesis: deltamethrin will become less toxic in the presence of microplastics due to strong binding, dimethoate toxicity will be unaffected



Mortality resulting from pesticides associated with microplastics





Deltamethrin



Horton et al. (2018) Ecotoxicology and Environmental Safety

microplastics

Immobility resulting from pesticides associated with microplastics

Horton et al. (2018) Ecotoxicology and Environmental Safety

microplastics

Chemical bioaccumulation and impacts on microbiome

 Great pond snail (Lymnaea stagnalis) 1% by mass nylon, 13-18 μ m + PBDEs

2000

Without microplastics

With microplastics

Horton et al. (2021) Environmental Pollution

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Impact on microbiome

Horton et al. (2021) Environmental Pollution

Conclusions

- the River Thames
- stagnalis

1. Microplastics were found to be present in the River Thames, many derived from road particles

2. Microplastics were ingested by 1/3 fish analysed in

3. Microplastics did not have a significant influence on pesticide toxicity to Daphnia magna

4. Microplastics did not significantly influence PBDE bioaccumulation nor microbiome in Lymnaea

Universiteit Leiden

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NERC SCIENCE OF THE ENVIRONMENT