UK Emissions from Novel Sources: Inhalable microplastics: a new cause for concern?

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Plastic in **our** environment

Synthetic textiles…clothes, furniture, carpets
Synthetic rubber…tires, shoes
Thermoplastic paints
Construction/buildings

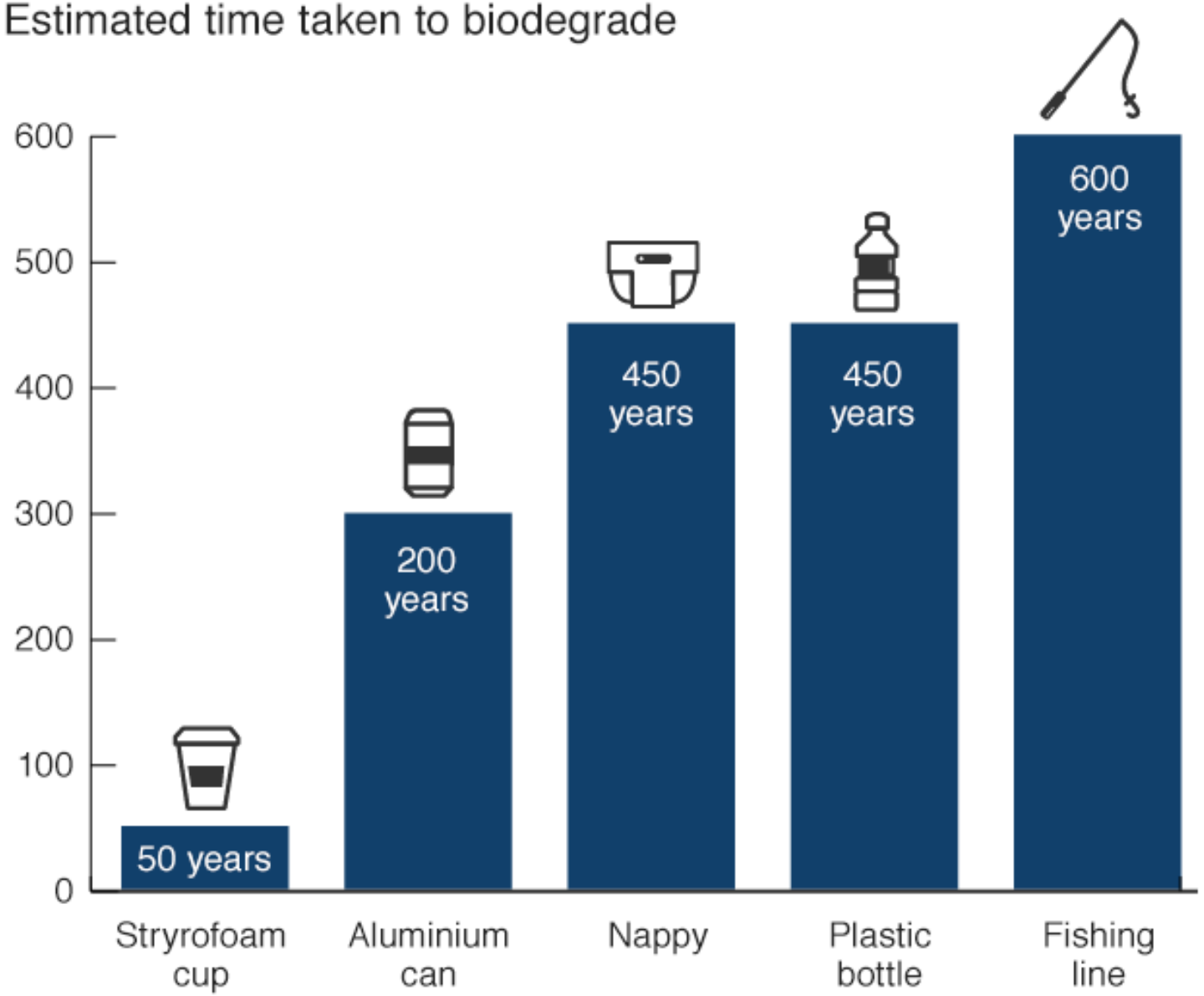
Plastic is really useful

Until we see it like this…….

Plastic debris is a rapidly emerging environmental issue

How long til they're gone?

Estimated time taken to biodegrade



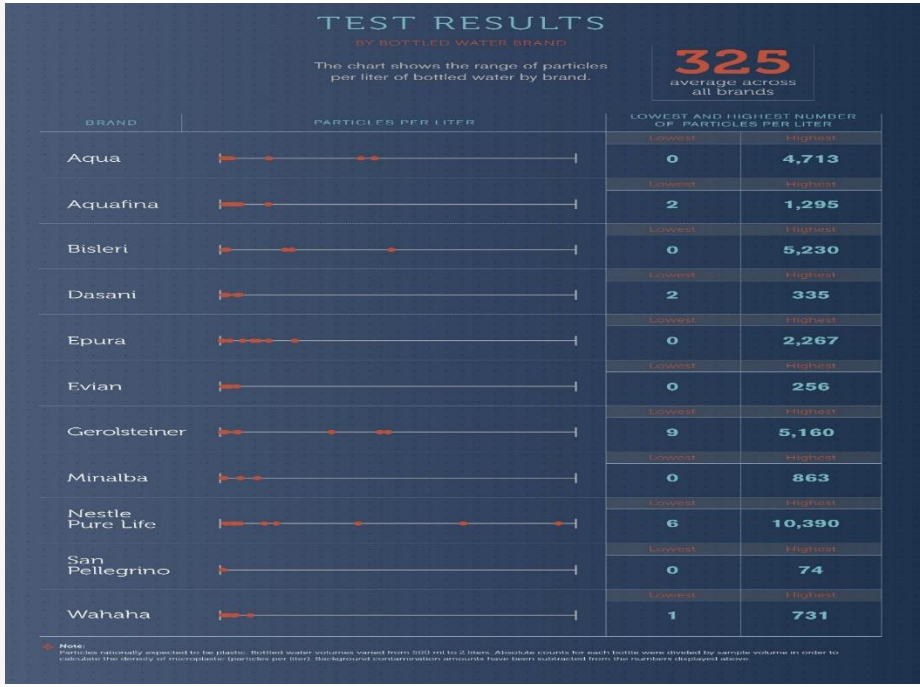
Exact time will vary by product type and environmental conditions

Source: NOAA / Woods Hole Sea Grant

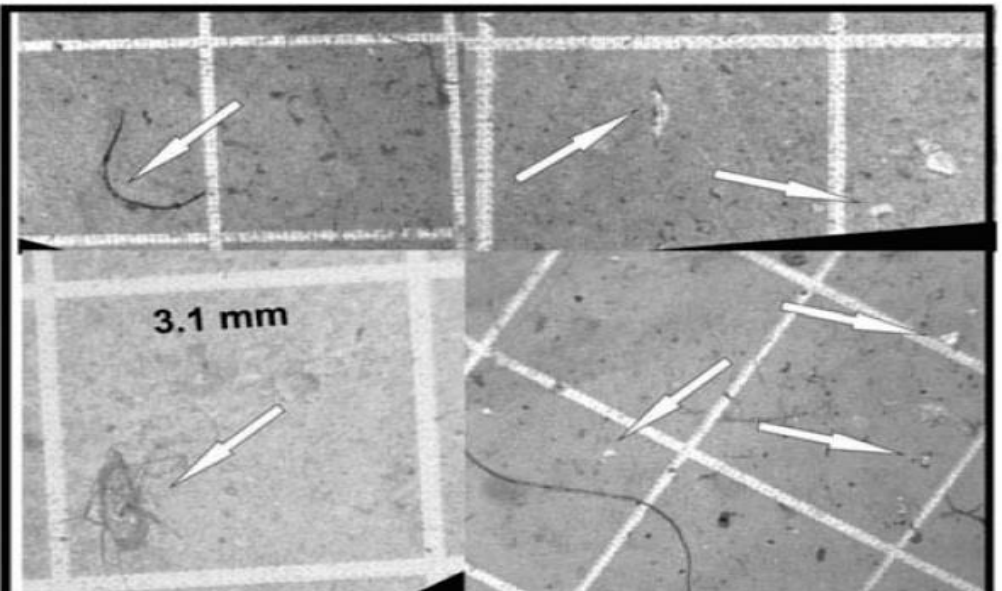
BBC

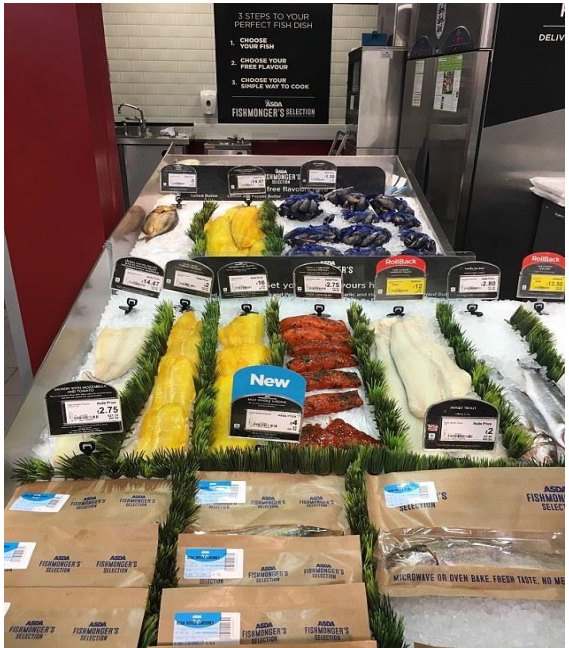
What is the evidence that microplastics is a human health issue?

Microplastics contamination of botted water



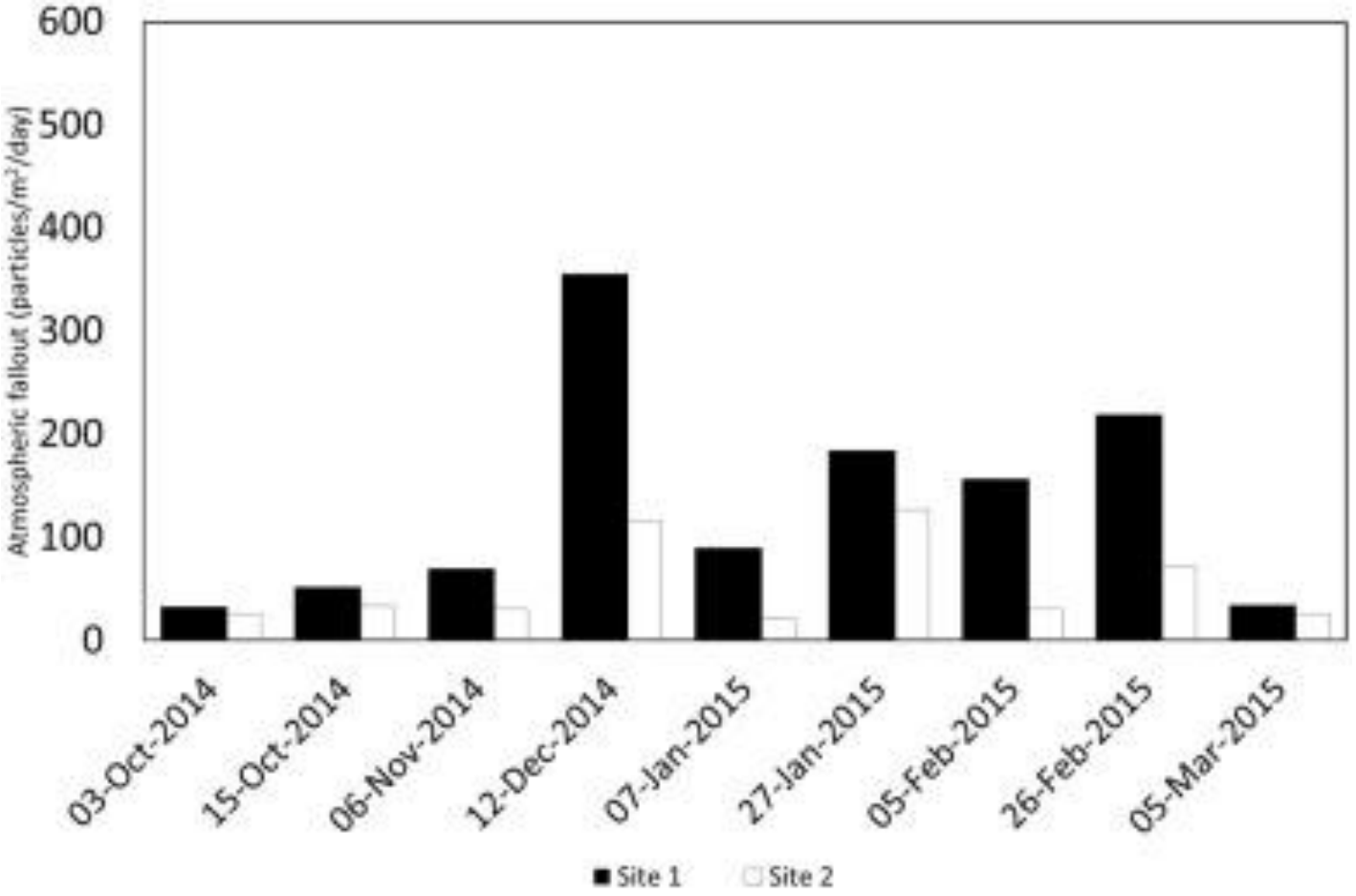
Synthetic particles in German beer

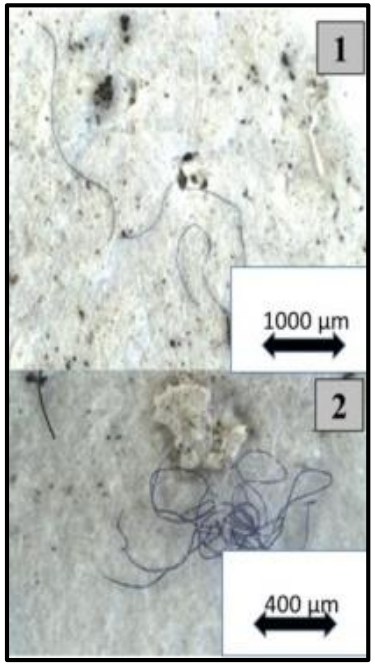




Supermarket fish all had microplastic contamination

Could microplastics be in the air ?





Dris et al., Society of Environmental Toxicology and Chemistry, 2016

The potential for microplastics to impact human health

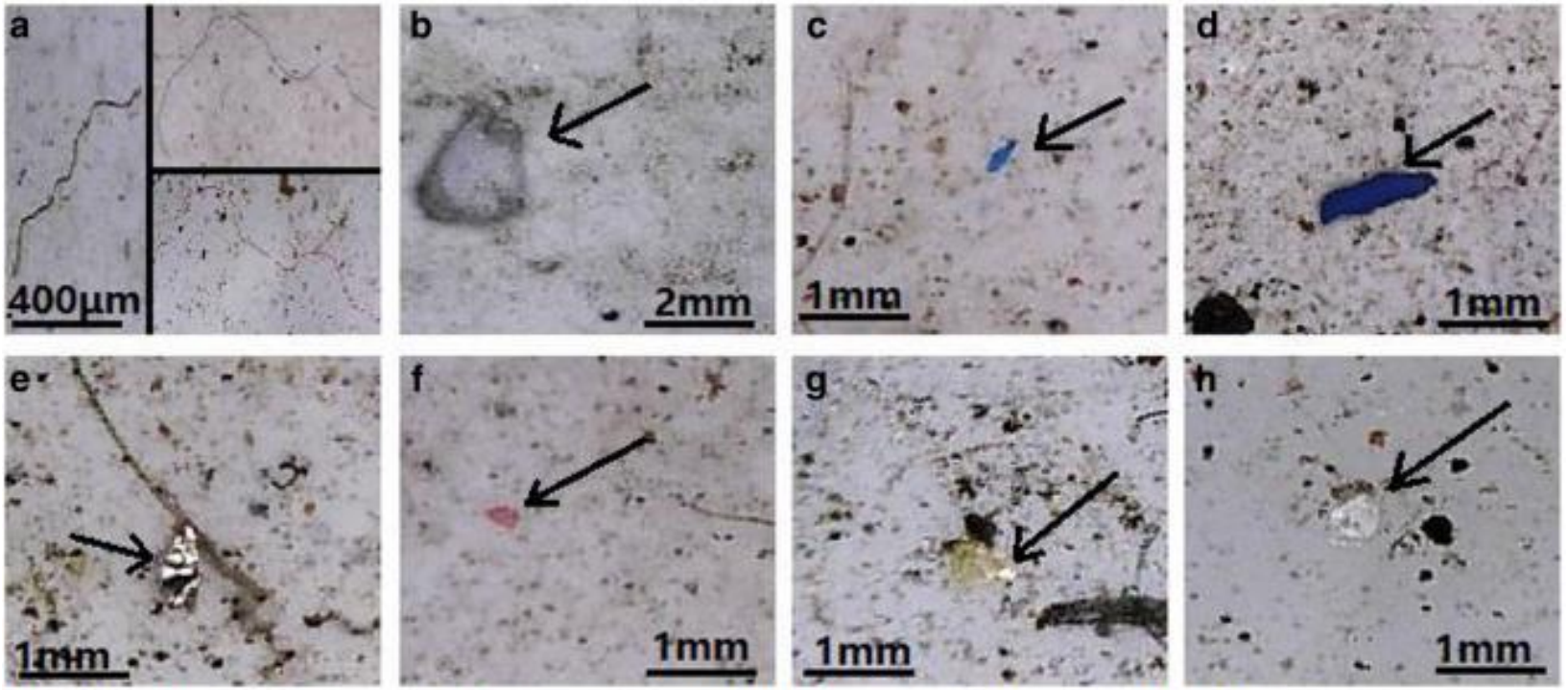


Fig. 2 Optical microscope images of selected polymers. **a** Colored fibers; **b** PS foam; **c–d** PP fragments; and **e–h** PE films

Cai et al., 2017

Wright and Kelly, *Environmental Science and Technology* 2017
Wright and Kelly, *BMJ*, 2017
Gasperi, et al, *Current Opinion in Environmental Science & Health, 2017*

The heath impact of traffic related particles is well understood

Are inhalable microplastics affecting our health ?

Occupational exposure

- **Flock (nylon) worker's lung** (*Kern et al. 1998, 2000, 2003*)
  - Cough; chest pain; infection in the airway; tissue inflammation
    - '**Health hazard exists from occupational exposures to flock–associated dust**' (National Institute for Occupational Safety and Health)

- **Other synthetic textiles** (plastic microfibres) (*Pimentel et al., 1975*)
  - Inflammation around acrylic/polyester/nylon dust; respiratory irritation.

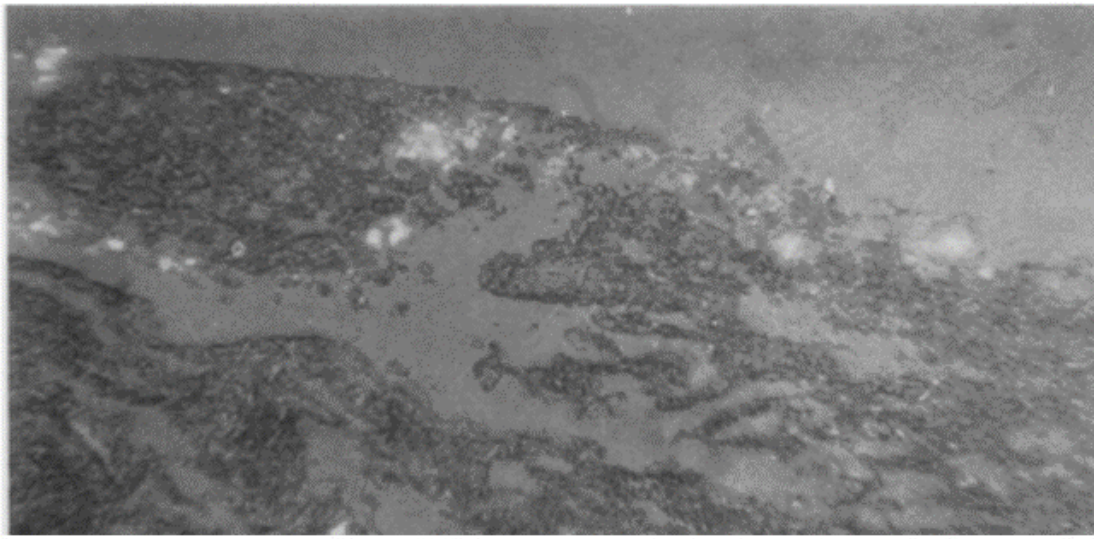


FIG. 10. *Case 5. (a) View of a zone of pulmonary lesions. Birefringent inclusions nylon (polarized light) (H and E ×15). (b) Same area as in (a) after addition of m-cres*

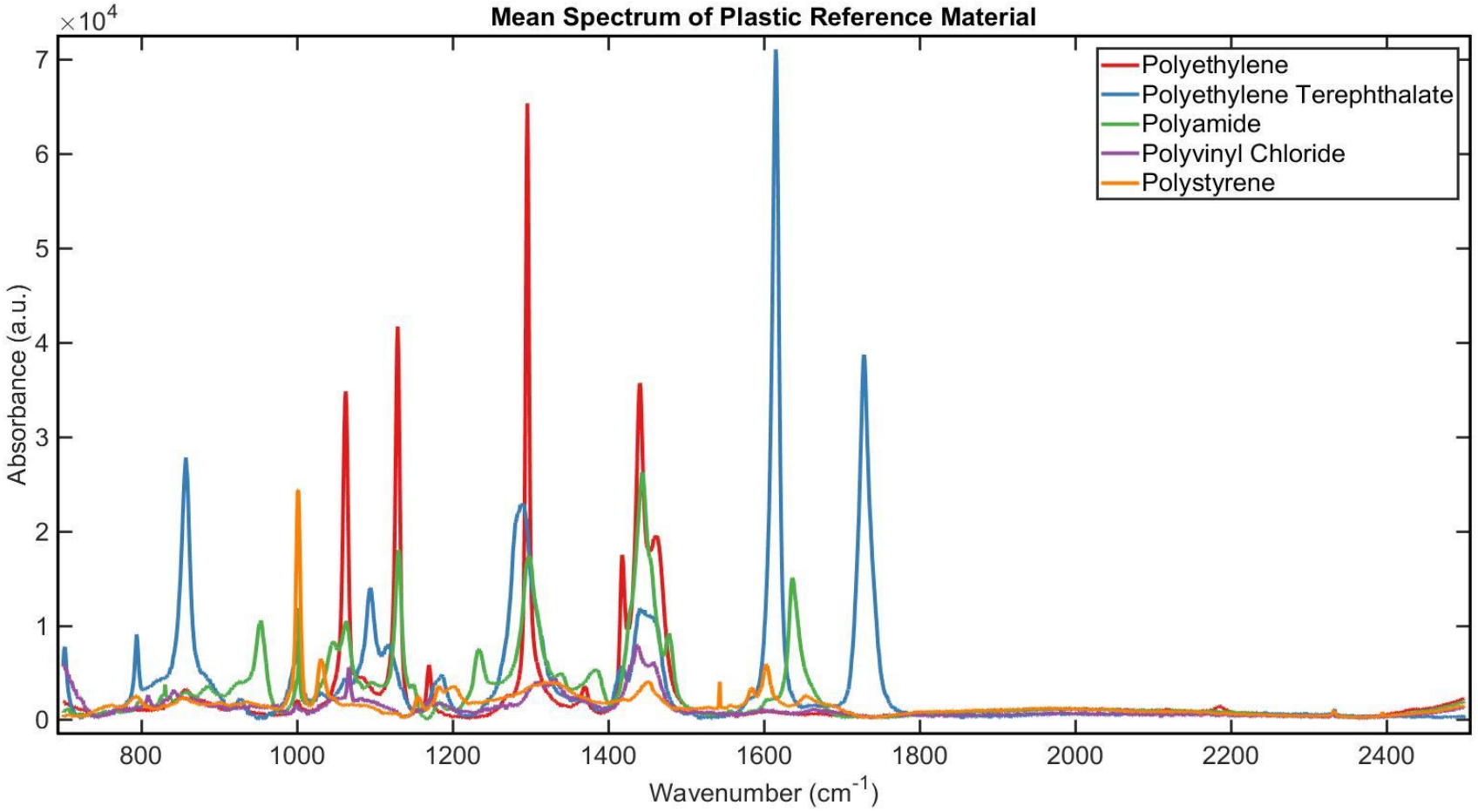
What we would like to understand

- Are inhalable microplastic’s present in the air ?
- If so, what are the dominate types ?
- At what concentration's are they present ?
- How do these concentrations vary by location ?

What we would like to understand (II)

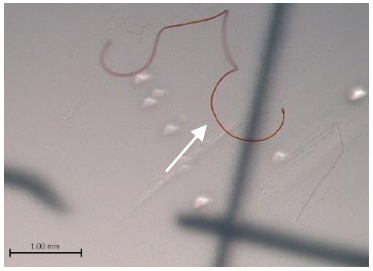
- Is microplastic toxicity influenced by the type, or age of the plastic ?
- If so, what are the most toxic combinations ?
- Are microplastic particles present in human samples – nasal lavage, induced sputum, etc ?
- How does exposure to microplastic particles influence their presence – bioaccumulation ?

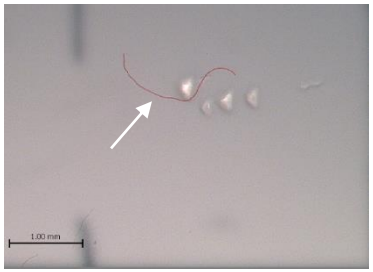
Summary of Reference Plastic Spectra



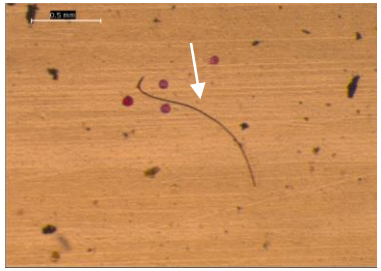
Suspicious Fibres and Particles

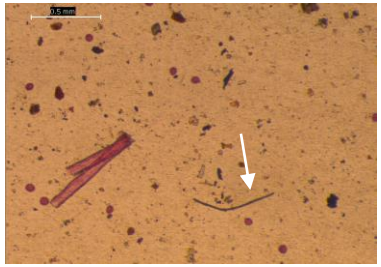
Domestic Vacuum Cleaner



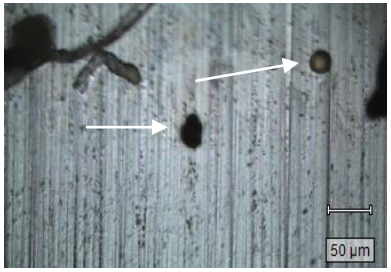


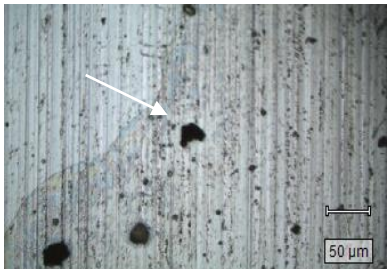
Volumetric Spore Trap Detector



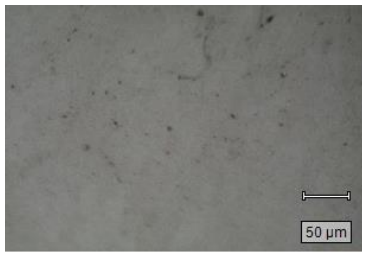


Multi-Vial Cyclone Sampler





Developing methods for sampling and detection of microplastics in complex samples

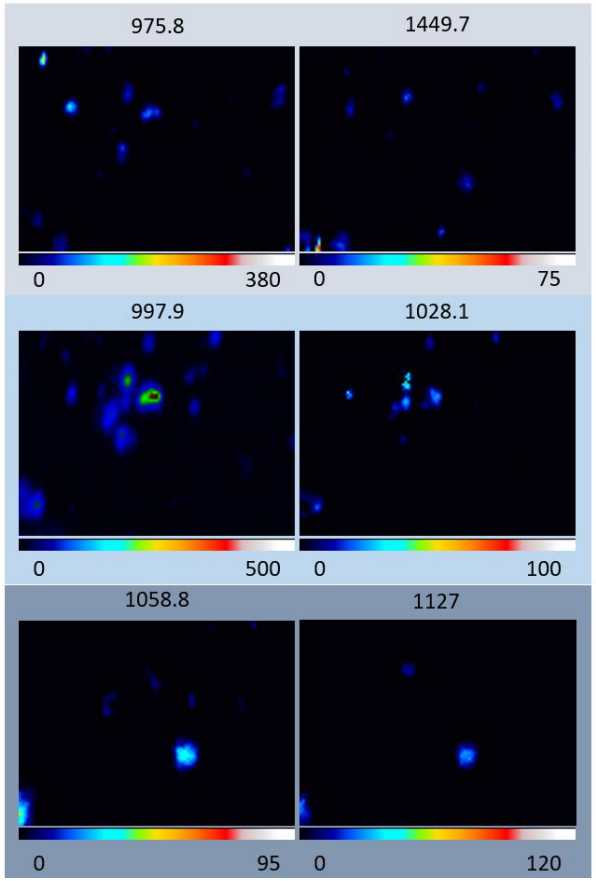


Particulate matter

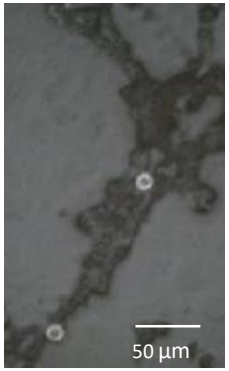
PMMA

PS

PE



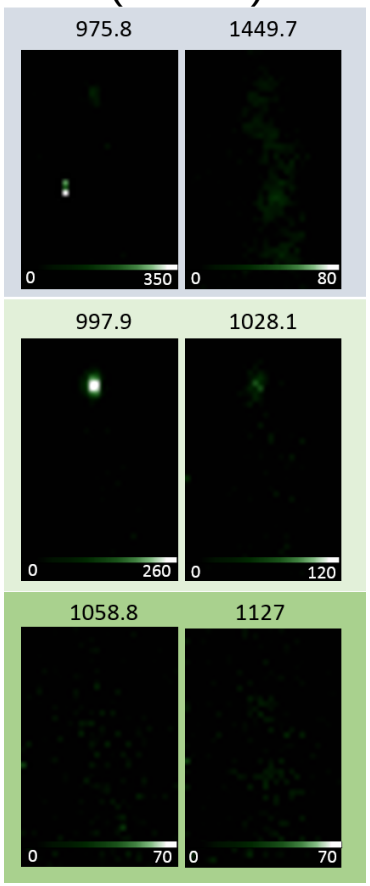
Pulmonary tissue (mouse)



PMMA

PS

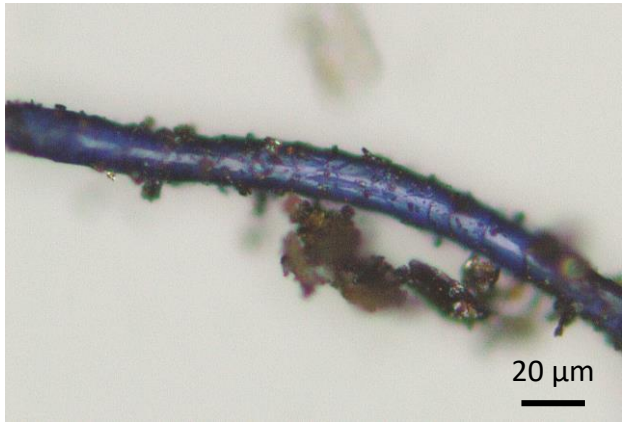
PE



Wright et al., *Environmental Science & Technology* 2019

Microplastic Toxicity?

- Unreacted monomers, additives, dyes and pigments
  - MPs ingested via mussels contribute est. 3.4 x 10^{-5} g BPA/person/y (Rist et al., 2018)
  - ↑ brominated flame retardants in household dust (210 mg g^{-1}) due to abrasion of particles/fibres from treated items (*Rauert et al., 2014*)
    - Est. contribute up to 15% exposure (Li et al., 2014)
    - Thyroid homeostasis/cognition (Howe et al., 2018)
- Sorbed HOCs/metals…particles?



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