Microplastics as a novel air pollutant: Challenges, implications and the future

Microplastics in the Ocean: Standards and Research Needs | 18th Oct 2019
Dr Stephanie Wright
How did I end up here?
Exposure in the airway

Microplastics contaminate the air

Fine PM$_{2.5}$
Ultrafine PM$_{0.1}$
Challenge: Can RSI be used to detect microplastics <10 µm?

Wright et al., 2019.
Meanwhile...

365/m²/d

Dris et al. 2016.

40/m²/d (size-adj)


Allen et al., 2019

95 km transport

Photo: peresanz/iStock
Challenge: are microplastics deposited from the atmosphere in urban London?

- 2x per week, 4 weeks (19\textsuperscript{th} Jan – 16\textsuperscript{th} Feb 2018)
- 3x 1L washes in succession
- Vacuum filtered onto silver membrane filters
  - Dried at 40 °C
- Nile Red staining (10 ug/L)
- Fluorescence microscopy/FTIR

Wright, Ulke et al., 2019. In review.
Wright, Ulke et al., 2019. In review.

712/m²/d

2 x 10⁹ C. of London
Challenge: Can we improve image analysis and LOD?

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Need to include airborne pathways in exposure estimates.

Levermore et al., 2019. In prep.
Implications: Public health?

Heart disease and stroke, lung cancer, chronic lung disease and respiratory infections
Implications: Occupational disease

Flock Worker’s Lung

Inflammation, fibrosis

Kern et al. 1998, 2000, 2003; Burkhart et al., 1999

~2.2 mg/m³ exposure
Future: Microplastic accumulation?

- 83% contained 1+ fibres
- 32/33 fresh malignant human lung tissue

- No diameters reported
- No scale bars
- No iron protein cover or foreign body reaction

Pauly et al., 1998
Future: Microplastic toxicity?

- Cytotoxic dose response
- Bronchial epithelial cells
- Size-separated powders, spheres, fibres (comparing same polymers of different shapes)
- Nasal and alveolar; inflammation
- Aged v ‘fresh’
- NEGATIVE CONTROLS

Environmental conditioning

Aging

Biological coatings

Harmful contaminants

- Organic pollutants
- Metals
- Biofilm/mineral attrition
- Additives
Recommendations/Thoughts

• Fill the knowledge gaps re. microplastics <10 µm for exposure estimates (PM10 and PM2.5)
  • Micro-vibrational spectroscopy and TD- or py-GC/MS
• The right models and the right endpoints
• Negative controls – particle v plastic effects
• ‘Age’ may influence harmful parameters
• Mismatch in dialogue, e.g. human stools; single-use plastic
Thank you

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