Engineering and Innovation Research Studentship 2023/2024

Project title:	**Plastic Vectors in the Air**
Discipline	Environmental Pollution and Sustainability
Key words:	Plastic, Pollution, Contamination, Ecotoxicity, Anti-microbial
Supervisory team:	Dr Catherine Rolph, Prof. Toni Gladding
URL for lead supervisor's OU profile	https://www.open.ac.uk/people/cr8724

Project Highlights:

- Opportunity to work on an important public health and ecosystem function related research question(s);
- Contemporary environmental issue investigated with extensive UK-based field work and international travel;
- Varied and multidisciplinary (chemistry/biology/engineering) project tailored to applicants interests and background.

Overview:

Microplastic (plastics <5 mm) pollution has been detected in every major natural ecosystem and built environment across the world, this includes remote regions such as the Pyrenees, the Arctic and the Mariana trench. Whilst plastic pollution in the world's oceans has received a tremendous amount of publicity and attention, the sources, sinks and impacts of airborne microplastics, particularly those from urban or industrial areas, has only recently been considered (figure 1). In particular, understanding how plastic may act as vector for pathogenic organisms, aid anti-microbial gene transference and transfer toxic trace-elements to organisms and humans, are areas where further work is needed. For example, it was recently shown that airborne microplastics can act as SARS-CoV-2 vectors.

This studentship can be tailored to the interests, background and skills set of the successful applicant. It is envisaged however that the project would undertake the detection and characterisation of airborne microplastics in different environments to determine major contributors to plastic load in the atmosphere. There is particular interest in exploring the contribution of different waste management practices to airborne plastic load and further the understanding of any associated risks should they be transported away from treatment sites.

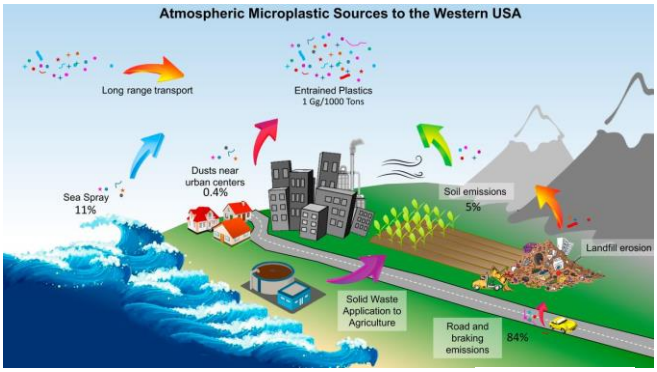

Figure 1. Atmospheric microplastic sources. Brahney, J., et al, 2021.

The project would look to characterise the type and size distribution of airborne plastics from designated point and linear sources in the first instance using a UK based fieldwork campaign. Atmospheric residency times and deposition profiles would be explored through transect analyses. After establishing the extent of the issue, it is envisaged that plastic surface chemistry and biological characterisations would be quantified and analysed to determine any potential risk.

Methodology:

The project would use high velocity sampling pumps deployed at likely sources (e.g. industrial sites, roads and potentially within buildings) to sample the air for plastic. The subsequent samples would be analysed using biological and chemical preparation techniques; Fourier transform infra-red and Raman spectroscopy are available, as is nuclear magnetic resonance analysis, electron microscopes and a full range of chromatography instrumentation. The OU has laboratories equipped for DNA sequencing.

References & Further reading:

1. Janice Brahney, J., et al. 2021. Constraining the atmospheric limb of the plastic cycle. PNAS. DOI:10.1073/pnas.2020719118.
2. Bradney, L., et al. 2019. Particulate plastics as a vector for toxic trace-element uptake by aquatic and terrestrial organisms and human health risk. Environmental international. https://doi.org/10.1016/j.envint.2019.104937.
3. Liu, Q., Schauer, J. (2021). Airborne Microplastics from Waste as a Transmission Vector for COVID-19. Aerosol Air Qual. Res. 21, 200439. https://doi.org/10.4209/aaqr.2020.07.0439
4. Batool, I., et al. 2022. Dynamics of airborne microplastics, appraisal and distributional behaviour in atmosphere; a review. Science of The Total Environment. https://doi.org/10.1016/j.scitotenv.2021.150745.

Further details:

A project in this area would suit a person who has a physical sciences, biology or chemistry background. This project has the potential to be multi-disciplinary, therefore there would be the opportunity to learn a wide range of cross disciplinary techniques under the supervision of experts. A successful applicant would join a well-established environmental and analytical team researching sustainable materials and the impacts of plastic pollution at the Open University. Please contact Dr Catherine Rolph (Catherine.Rolph@open.ac.uk) for further information.

Applications should include:

- A 1000 word cover letter outlining why the project is of interest to you and how your skills match those required
- an academic CV containing contact details of three academic references
- an Open University application form, downloadable from: http://www.open.ac.uk/postgraduate/research-degrees/how-to-apply/mphil-and-phd-application-process
- IELTS test scores where English is an additional language

Applications should be sent to **STEM-EI-PhD@open.ac.uk** **by 15.02.23**