PhD position

Tracking plastic particles and co-contaminants in biological tissues

Principal supervisor: Dr Maya AL SID CHEIKH
Co-supervisor: Dr Melanie Bailey

Start date July or October 2021

Standard project duration is 4 years

Deadline May 19th 2021

Directly funded project - UK/EU students only

This research project has funding attached

The project proposes to push forward a ground-breaking approach to tackle directly the analytical issue of tracking plastic particles and their impact in biological tissues, which will forward-orientate the future ecotoxicological studies on plastic litter. In this project, we will characterise the tissue distribution of plastic particles, co-contaminants and associated metabolites in model biological tissues by developing a novel elemental/molecular analytical method using the ion beam/mass spectrometry facilities at Surrey to match the method already developed by Dr Al-SID-CHEIKH using radiolabelling of plastic polymers.

Project description

Plastics are lightweight, inexpensive, and highly durable materials that are used in a wide variety of products which have infiltrated almost every aspect of modern life, displacing other materials and revolutionizing contemporary society. It is estimated that up to 51 trillion microplastic (MP, <5mm) fragments have accumulated at the sea surface and that quantities will continue to increase. Most scientists working in the field consider that plastic objects are fragmenting into even smaller nano-sized pieces (nanoplastic, NP; <1000nm). A huge amount of MP/NP is therefore accumulating in the environment every year, with concerns about associated toxicological effects.

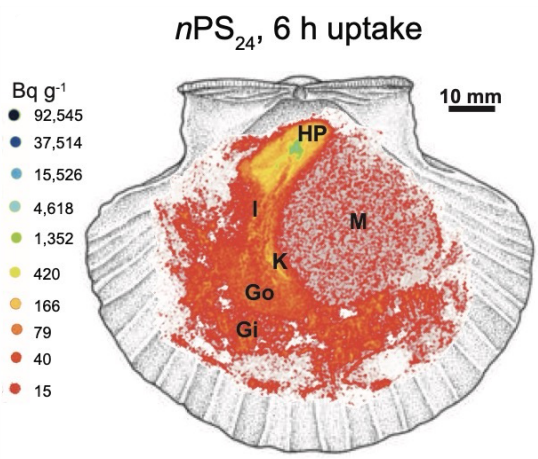

Figure 1. Tissue distributions of 20 nm ^{14}C-labelled polystyrene nanoparticles by Quantitative Whole-Body autoradiography (QWBA) in Pecten maximus after 6 h uptake. HP: Hepatopancreas, Gi: Gills, Go: Gonad, I: Intestine, K: Kidney, M: Muscle, A: Anus.

One of the main concerns about plastic particles in the environment is their potential effect on aquatic organisms and their potential transfer in the food web. NP may reduce zooplankton survival and introduce behavioural disorders in fish, which have been postulated to result from NP penetrating the blood-to-brain barrier. However, **due to the analytical challenge, no studies have yet demonstrated NP elemental/molecular biodistribution in higher level animal (e.g. fish, rodent) and the potential to reach critical organs such as the brain.** Consequently, it is difficult determine whether the causes of any changes in behaviour or survival are related to physical damage to the digestive tract, to NP crossing blood-to-brain barrier or to the excessive plastic concentrations used. **Such assessments need to develop ways to track directly NP** and **quantify** their residence time, tissue distribution (potential absorption blood, brain, liver, kidney, intestine) and potential for trophic transfer.

This project will push forward a complementary analytical method to the radiolabelling approach already developed by the Dr Al-Sid-Cheikh (Figure 1; https://www.surrey.ac.uk/people/maya-al-sid-cheikh) to investigate the potential risks of NP to organisms in environmentally realistic scenarios. We will develop with **Dr Bailey** (https://www.surrey.ac.uk/people/melanie-bailey) a complementary elemental and molecular characterisation of plastic particles, co-contaminants and associated metabolites in biological tissues.

The successful student will have access to the 'Applied Radioisotope & Environmental Laboratory' (ARIEL) and the UK national ion beam centre. The candidate will be trained at the ion beam platform on Particle-induced X-ray emission (PIXE) and secondary ionisation mass spectrometry (SIMS) techniques, as well as to the use of radioisotope. Student will be trained to work with animals and biological tissue preparation (cryo-sectioning, histology). Candidate holding a 'personal licence' (PIL) with knowledge on the Animals Scientific Procedures (ASPA) or similar is an asset.

Related link

https://www.surrey.ac.uk/ion-beam-centre

https://www.surrey.ac.uk/news/new-method-label-and-track-nano-particles-could-improve-our-understanding-plastic-pollution

Requirements

We are looking for enthusiastic, committed students who enjoy working as part of a team and doing research with an impact. Candidates should have or shortly be about to complete an honours degree in the Chemistry or biochemistry (and other closely related field, e.g. environmental, biomedical, pharmacology sciences etc.) with a predicted or achieved grade of 2.1 or above, a Master's degree, or substantive relevant work experience. Strong Analytical Chemistry and method development skills are an asset.

IELTS Academic 6.5 overall with 6.0 in Writing, or equivalent

Programme: Chemistry PhD

How to apply:
Please clearly state the studentship title and supervisor on your application. Your application must include a copy of your CV, your academic transcripts, the name and contact details for two referees, and a separate cover letter (max. 1 page) describing your research interests, skills and motivation to apply for the position.
https://www.surrey.ac.uk/fees-and-funding/studentships/tracking-plastic-particles-and-co-contaminants-biological-tissues

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