

## PhD Project Advertisement

**Project title:** *Translocation pathways of gadolinium from wastewater into the food chain: accumulation, distribution and speciation in crops*

**Project No:** FBS25-63-Felipe-Sotelo-sr

**Lead supervisor:** Dr Monica Felipe-Sotelo, School of Chemistry and Chemical Engineering, University of Surrey

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**Co-supervisors:**

Professor Tom Sizmur, Department of Geography and Environmental Science, University of Reading

Dr Carol Crean, School of Chemistry and Chemical Engineering, University of Surrey

**Project description:** The use of rare earth elements (REE) has dramatically increased over the last 30 years, due to their extensive use in technological equipment and in medical applications. Gadolinium (Gd) is an REE used as a contrast agent prior magnetic resonance imaging (MRI), excreted mostly after few hours from treatment and released into the wastewater. Under environmental conditions the contrast agent can suffer degradation, resulting on the release of free gadolinium ion, known to cause adverse effects in human such as damage to the nephrological system. Therefore, wastewater is a major source of anthropogenic Gd to the aquatic environment and is then transferred to the terrestrial environment through fluvial flooding and wastewater irrigation.

This PhD project aims to tackle some of the existing knowledge gaps concerning the uptake of gadolinium by crops and understanding of its toxicology and translocation from the roots to the edible part of the plants. This will provide the knowledge necessary to stablish the level the risk to food security and safety and inform the development of monitoring and mitigation strategies.

This project will include the sampling and analysis of soils and vegetation in areas of the Thames basin to demonstrate the accumulation of Gd in floodplains. We will investigate the uptake of free-Gd by wheat grown under green-house conditions, assessing the dose/response and toxicity to plants by testing of antioxidant activity. Finally, we will study the process of translocation of the Gd within the plant tissues using advanced atomic spectroscopic techniques for elemental mapping.

**Training opportunities:** The student will integrate within the multi-disciplinary community of the School of Chemistry and Chemical Engineering with a general interest in sustainability topics. The student will have the opportunity of attending weekly seminars organized by the School, the annual Post-Graduate Research Conference and, join the RSC and attend training events by the Analytical Science Community. The student will receive a multidisciplinary training with strong emphasis on ecotoxicology, data analysis and analytical chemistry. This will include the use of cutting-edge atomic spectroscopy techniques such as laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) to investigate metal distribution in biological tissues. The student will learn new skills related to soil science to investigate the factors affecting bioanalysis and toxicity of gadolinium on crops. The student will participate in weekly seminars organized by the 'Soil Biogeochemistry Group', focused on a broad suite of interactions between soil and the global environment.

**Project supervision style:** During the 1st year, there will be weekly 1-to-1 meetings with the main supervisor to guide them through the experimental plan, laboratory and transferrable-skills training. Once a month they will meet on-line with the two supervisors and it will be officially recorded through SITS (UoS). After 12-15 months into the project the student should take more ownership of the project and the meetings with the main supervisor will be of biweekly frequency. The supervisors will ensure that both academic and wellbeing needs of the student are met, officering frequent and welcoming opportunities for communication. Biannually, there will be an official meeting and completion of 6-month reports for evaluation of progress and planning. Formal feedback with me provided in this joint meeting and will be submitted and signed off by the School's Postgraduate Research Director.

**Student profile:** This project would be suitable for students with a background in environmental science or chemistry. Knowledge or interest in soil science, inorganic geochemistry, or analytical chemistry will be useful.

**Stipend (Salary):** FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2024/25 this is £19,237 (£21,237 at Brunel University) and it will increase slightly each year at rate set by UKRI.

**Equity Diversity and Inclusion:**

The FoodBioSystems DTP is committed to equity, diversity and inclusion (EDI), to building a doctoral researcher(DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the [FoodBioSystems DTP website](#) and include:

- Offering reasonable adjustments at interview for shortlisted candidates who have disclosed a disability or specific learning difference.
- [Guaranteed interview](#) and [applicant mentoring](#) schemes for applicants, with UK home fees status, from eligible under-represented ethnic groups.

These are opt-in processes.

Our studentships are offered on a part time basis in addition to full time registration. The minimum registration is 50% FT and the studentship end date will be extended to reflect the part-time registration.

**For up to date information on funding eligibility, studentship rates and part time registration, please visit the [FoodBioSystems website](#).**