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Access to Research

Future Fluid Dynamics

Research Internship Programme

Candidate brief

Evaluation of fluid dynamic parameters on ion-exchange fluoride capture and recovery technology

Evaluation of fluid dynamic parameters on ion-exchange fluoride capture and recovery technology

Project supervisors: Dr Timothy Hunter, Dr Thomas Robshaw
Department: School of Chemical & Process Engineering, Nuclear Energy Group (NEG)

Duration: 6 weeks FT (or PT equivalent)
Start date: June 2025
Stipend: £3,517
Location: University of Leeds campus

Project summary

Fluoride pollution in drinking water remains a significant public health threat in many parts of the world. It is estimated >200m people are consuming over the recommended fluoride daily intake. Dissolved fluoride in water is potentially valuable, if recovered and converted to industrially-useful chemicals. Fluorite (calcium fluoride) is considered a "critical mineral" for conservation, in Europe and the United States. However, established methodologies mainly focus on reducing fluoride concentration to safe levels, rather than concurrent valorisation.

We have recently started collaborations with researchers in Tanzania (a country where fluoride pollution presents a serious problem) to establish remedial actions. Previous work has developed a dynamic water-treatment process, using a form of ion-exchange, to remove and recover fluoride from water. This system has showed promising performance in the treatment of certain industrial wastewaters. However, further work is needed to explore its capabilities for treating the contaminated groundwater in countries where the fluoride presents a health risk. Furthermore, the technology needs to be properly assessed within the local context, to ensure implementation is feasible.

The most likely implementation for the system is direct interception of point pollution source. This is challenging, because the setup will have to deal with fluctuating temperatures and liquid volumes, including periods of drought and high, possibly turbulent, flow. Also, particulates, resin foulants and pH-changing species are likely to be present. The effects of these variables on adsorbent performance and durability are very rarely tested in a laboratory setup and it is important to expose a hydrodynamic system to realistic field conditions.

Therefore, the main objective of this internship will be to build a detailed assessment of the performance of the hydrodynamic treatment for fluoride under these conditions; to

investigate the limits of the system and in the event of breakdown, to investigate and implement corrective action.

Developmental benefits

- The internship is expected to rapidly develop the candidate's practical laboratory skills and confidence in a laboratory setting, promoting their growth as an independent researcher. The practical work will combine chemistry, analytical science and process engineering.
- They will have opportunities to observe and operate high-end analytical and process equipment.
- The intern will become an integral part of an experienced research group and, with appropriate supervision and mentoring, will be encouraged to contribute to technical discussions and project-management meetings. Their role in these inputs is expected to develop and grow alongside their confidence. They will have the opportunity to present work to an array of stakeholders, with genuine investment in their work.
- The intern will experience the benefits and complexities of conducting international research. Through our collaborators in Tanzania, they will have a direct line of sight, showing the benefits and beneficiaries of their actions as a researcher. They will develop a thorough understanding of the global issue of fluoride contamination an appreciation of the advantages and constraints of the project's unique international context.

Essential criteria

Applicants to this project should have:

- Maths and IT literacy
- Ability to work as part of a diverse team
- Willingness to learn laboratory skills, handle chemicals and use process equipment
- Ability to communicate their research findings orally and in reports
- An interest in water-treatment and/or resource-recovery

Who should apply

On order to be considered for this opportunity, applicants must be eligible for the **Home (UK) rate of postgraduate academic fees**, must **not** have previously undertaken a research internship with the Leeds Centre for Doctoral Training in Future Fluid Dynamics **and meet one or more** of the below criteria:

- First in family to go to university
- From a Black, Asian or other minoritised ethnic group
- Neurodivergent (e.g. ASD, ADHD) and/or Disability (e.g. physical impairments, mental health condition, learning difficulties, chronic illness)

- Identify as female
- Have caring responsibilities
- Have been outside of education for 5 or more years
- Studying/studied at a university that is not a member of the Russell Group*

If you have any questions or would like to discuss your eligibility, please contact pgrdiversity@leeds.ac.uk

How to apply

Before making an application, you should review the essential and eligibility criteria above. Please note that if you do not meet the stated eligibility criteria your application will not be shared with the shortlisting panel for review.

You can submit your application by completing the form below:

Future Fluid Dynamics Internship Programme (2025): Application form

Applications close at 23:59 on Friday 31 January 2025.

If you have any questions about your application, please contact Emily Bryan-Kinns by email at e.bryan-kinns@leeds.ac.uk.

If you require information for disabled applicants, or would like to request alternative formats, please contact the PGR Diversity Team by email at pgrdiversity@leeds.ac.uk.