

Academic Supervisor Looking for an Industry Partner

Advanced Technologies for Water Remediation and Self-Powered On-Site Monitoring

Area of Science: Chemical Sciences (Environmental Chemistry and Materials Engineering)

Nitrates and phosphates are among the primary contaminants affecting water quality in Ireland, originating from agriculture, wastewater discharge, and sewage systems. These pollutants pose significant risks to human health and ecosystems, while also creating increasing regulatory pressure for improved monitoring and treatment solutions. Current sensing and filtration technologies are often energy-intensive, costly, and difficult to deploy at scale. This project develops an **integrated approach combining water remediation and real-time monitoring**, enabling efficient treatment and on-site detection of contaminants. The approach focuses on advanced functional materials and self-powered sensing systems to reduce energy demand and improve operational efficiency.

The methodology integrates:

- **Catalytic materials on porous metallic substrates** to enable efficient degradation of contaminants with high surface area and low-cost fabrication methods
- **Self-powered sensing systems** based on triboelectric nanogenerators for real-time, on-site detection without external power sources
- **Data-driven modelling and machine learning** to analyse monitoring data and predict contaminant transmission patterns

The integration of remediation and sensing enables targeted and responsive water treatment, while reducing system complexity and operational costs.

Industry Relevance

The project directly addresses:

- need for cost-effective and scalable water treatment solutions
- increasing regulatory requirements for water quality monitoring
- demand for low-energy and decentralised treatment technologies

It enables:

- on-site monitoring and treatment in agricultural and industrial settings
- reduction of operational and energy costs
- improved prediction and management of contaminant spread

Expected Outcomes

- Portable, self-powered water monitoring devices
- Efficient catalytic systems for nitrate and phosphate removal
- Integrated treatment and monitoring framework
- Reduced energy use and operational costs

Industry Mentor Role

- Provide input on real-world water treatment challenges
- Guide application scenarios and deployment pathways
- Offer periodic advisory feedback (low time commitment)

Contact

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