# ELITRE

Electrochemical recovery of nitrogen vectors from wastewater



Water4All
Water security for the planet

Coordinated by Early Career Researcher

## Abstract

A large fraction of European water suffers from eutrophication induced by high nitrate concentrations contained in agricultural runoff, while food production continues to heavily rely on ammonia-based fertilizers, a critical chemical with a large carbon footprint.
eLitre (Electrochemical Recovery of Nitrogen Vectors from Wastewater) proposes to develop integrated electrochemical and photobiological processes to address excess nitrate species in wastewater streams.

The technology developed in eLitre could actively help remediate nitrate-contaminated water bodies while upgrading nutrients back into raw materials for fertilizer applications. eLitre's direct path to impact lies in its contribution to water circularity and nutrient recovery and revalorization.
With the electrochemical processing pathway, eLitre pursues the direct conversion of nitrate species dissolved in wastewater into ammonia, at high nitrogen conversion rates, selectivity and rates.
In this context, eLitre will develop catalysts and systems that are tailored for the specific water streams enabling efficient anode operation to oxidize water and content, combined with cathodic valorization of nitrates into ammonia. Powered with renewable energy, this will enable the direct electrosynthesis of ammonia with minimum carbon footprint, as opposed to the widespread Haber Bosch, with the added value of water treatment and circularity.

eLitre will further develop advanced valorization pathways using the resulting ammonia and photobiological processes, seeking to realize high-value-added products such as biopolymers, carotenoids and Omega-3 fatty acids from otherwise carbon-nitrogen imbalanced nitrogen digestates.

eLitre will develop and assess these processes using wastewater streams from agricultural and urban environments. These recovery and valorization processes will be combined with novel rapid water monitoring technologies based on biophotonic probes. These will enable the quantification of nitrate and other biological species relevant to the application.
eLitre seeks to implement these into a small scale prototype using real wastewater streams enabling the treatment of water at litre-per-hour scales with minimum energy intensity and carbon footprint, targeting a TRL 5 at the end of the project.

With this, eLitre could contribute to the enhancement of water circularity in both agricultural industries and urban settings, including resource recovery and valorization and experimentally informed economic and environmental assessments. The consortium involves both early career and consolidated researchers from the public research and private sectors, and also includes stakeholders from policy making of different jurisdictions.

### Project coordinator

**F. Pelayo GARCIA DE ARQUER** - THE INSTITUTE OF PHOTONIC SCIENCES - SPAIN

### Project partners

- UNIVERSITY OF GALWAY - IRELAND
- LODZ UNIVERSITY OF TECHNOLOGY - POLAND
- DELFT UNIVERSITY OF TECHNOLOGY - THE NETHERLANDS
- ACSA, OBRAS E INFRAESTRUCTURAS, S.A.U. - SPAIN

### Funding organisations

AEI (SPAIN) / EPA (IRELAND) / NCBR (POLAND) / NWO - (THE NETHERLANDS) / CDTI (SPAIN)

### Duration

3 years

### Contact

**F. Pelayo GARCIA DE ARQUER**
pelayo.garciadearquer@icfo.eu

**KEYWORDS**

electrocatalysis,
nitrate electroreduction,
water electrolysis,
photobio reactors, Biopolymers,
water monitoring