MAR2PROTECT

Innovation Factsheet

Novel adsorption biomaterial based on residual biomass from *Juncus maritimus* for the removal of micropollutants from wastewater effluent

Problem Solved

Groundwater contamination by pharmaceutical compounds (e.g., valtarsan, iopromide, or diclofenac) and persistent PFAS (e.g., perfluorooctanoic acid (PFOA), perfluorobutane sulfonic acid (PFBS), or perfluoropentanoic acid (PFPeA) is a growing threat to safe managed aquifer recharge (MAR) operations across Europe and beyond. Existing solutions such as reverse osmosis are energy-intensive, costly, and generate secondary waste, or the presence of impurities and coexisting pollutants in real matrices adversely affect adsorption performance. There is a strong demand for sustainable, low-cost, bio-based alternatives with comparable or superior removal efficiency, especially as EU water reuse regulations (EU 2020/741) tighten pre-treatment standards for MAR.

How It Works

The technology uses the salt marsh plant *Juncus maritimus* as a bio-based raw material (JM-Bioadsorbent) to produce a novel biosorbent capable of absorbing and removing micropollutants (pharmaceuticals and PFAS) from aqueous solutions. The biomaterial is derived from the residual plant biomass (post-harvest waste), processed and functionalized to enhance its adsorption capacity. Lab and pilot-scale tests confirmed high elimination rates for the targeted contaminants, outperforming commercial alternatives (e.g., Norit activated carbon) in terms of removal efficiency for pharmaceuticals and PFAS.

Unique Value Proposition

Micropollutant adsorption processes using biobased materials that have significantly higher PFAS & pharmaceuticals removal capacity than commercial alternatives. Lower environmental impact and reduced operational costs.

The JM-Bioadsorbent is the only biosorbent derived from salt marsh plant waste that combines superior micropollutant removal (pharmaceuticals + PFAS) with a low environmental footprint and circular economy approach (use of residual biomass). It offers lower operational and maintenance costs compared to reverse osmosis and higher removal performance in comparison with commercial activated carbon (AC). Patent protection secures commercial exclusivity and opens licensing opportunities.

Result Identification

Technology Short Name

JM-Bioadsorbent.

Full Name

Novel adsorption biomaterial based on residual biomass from ***Juncus maritimus*** for the removal of micropollutants from wastewater effluent.

Lead Partner

Associação para a Inovação e Desenvolvimento da Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa (NOVA), Portugal.

Work Package / Task Related Deliverables

WP2 and WP5.

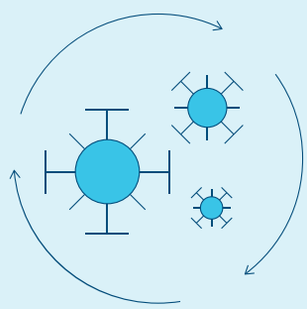
D2.5, D2.6, D5.2, D5.4.

Current TRL

TRL 4-5. Validated in lab and pilot scale.

KER Type

Process → Material (patentable).



- **Efficiency:** to remove these pollutants from wastewater effluent: 80-100% PFAS and 90-100% pharmaceuticals in Lab & 80-100% PFAS and 40-80% pharmaceuticals in pilot-plant.
- **Cost:** lower operating cost than commercial activated carbon (1.98 €/m³ vs. 2.04 €/m³ of treated wastewater in pilot-scale operation).
- **Safety:** bio-based adsorbent produced from residual plant biomass and validated in laboratory and pilot-scale wastewater treatment systems.
- **Sustainability:** lower environmental impact than commercial activated carbon, with ~6% reduction in total life-cycle environmental burden and a circular-economy approach based on residual biomass valorisation.
- **Competitive advantage:** bio-based solution derived from residual biomass, delivering superior pollutant removal performance at lower cost than commercial activated carbon.

Target Markets & Users

Segment	Description	Role
Water utilities, drinking water/water suppliers	Utilities managing wastewater treatment, water reuse and MAR schemes	Primary user; buyer
Industrials (SMEs and large companies)	Water-treatment and environmental-technology companies able to manufacture, integrate and commercialise the bioadsorbent	Potential licensee; manufacturer
Farmers	Users of reclaimed water requiring appropriate pre-treatment before irrigation	Secondary user; beneficiary
Government and international organisations	Environmental and water authorities overseeing water-reuse, discharge and groundwater-protection requirements	Regulator; policy maker
Academia and research community	Research organisations supporting optimisation, scale-up, performance assessment and independent validation	Research and validation partner

Exploitation Route & Business Model Outline

Exploitation route	Licensing of patented technology to water treatment companies; direct sales of material
Revenue model	Licensing fees (royalties), material supply contracts
IP strategy	Patent (PT filed, international expansion planned)
Next steps	PCT/EP application within 12 months; pilot upscaling; engage water technology companies for licensing discussions

Contact **Ana Belén Pereiro Estévez** (anab@fct.unl.pt) from **NOVA**, for licensing opportunities, co-development opportunities, pilot testing, technical integration discussions, and for any project coordination matters. Collaboration, exploitation, and technology transfer opportunities are supported by **FEUGA**, the project's Technology Transfer Entity.

Discover all the technologies!

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