

Scalable Graphene-Based Electrochemical Technology for the Remediation of PFAS in Industrial Wastewater Effluents

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More than 150,000 sites across the United States and Europe are currently impacted by per- and polyfluoroalkyl substances (PFAS), creating a rapidly growing environmental liability for industry and public authorities. These “forever chemicals” are highly persistent, bioaccumulative, and increasingly regulated due to their links to cancer, endocrine disruption, and immune system effects. PFAS have been widely used since the 1940s across multiple industrial sectors, including metal finishing, textiles, firefighting foams, and, critically, semiconductor manufacturing. For industrial operators, PFAS contamination is no longer only an environmental issue, it is a compliance, cost, and reputational challenge. Current solutions rely heavily on concentration technologies or high-cost incineration, which do not provide a sustainable or circular pathway. At the same time, PFAS-free alternatives are not yet viable for many high-performance applications, reinforcing the need for effective end-of-pipe destruction technologies.

GRAPHEC Water Technologies S.L. is developing a scalable graphene-based electrochemical treatment system designed specifically to address this gap. The core of the technology is a proprietary graphene sponge electrode that enables the direct electrochemical destruction of PFAS and other persistent organic pollutants in water and industrial effluents¹⁻⁵. Unlike conventional electrochemical systems, the GRAPHEC electrode is inert to chloride¹, preventing the formation of toxic chlorinated byproducts which is an important advantage for industrial deployment and regulatory compliance. The graphene material can be engineered to enhance electrocatalytic performance and target specific contaminants, enabling the degradation of even highly stable and polar compounds such as trifluoroacetic acid (TFA). The technology has already been validated across multiple water matrices, from drinking water to complex industrial waste streams such as landfill leachate and semiconductor industry wastewater, demonstrating robustness under real-world conditions²⁻⁴.

GRAPHEC Water Technologies, backed by a European Innovation Council (EIC) Transition Grant FOREVER-WATER⁶, is now focused on scaling this solution toward commercial deployment, advancing to Technology Readiness Level (TRL) 6. The objective is to deliver an energy-efficient, modular, and industry-ready system capable of on-site PFAS destruction, reducing reliance on off-site disposal and lowering overall treatment costs. This approach supports industrial clients in meeting tightening regulatory requirements while enabling more sustainable water management practices. By combining advanced graphene materials with electrochemical engineering, GRAPHEC is positioning itself as a key technology provider for the next generation of PFAS remediation solutions.

References

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