

# Sustainable Semi-aromatic Polyamide Nanofibers Enable Closed-Loop Forever Chemical Remediation



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## Background

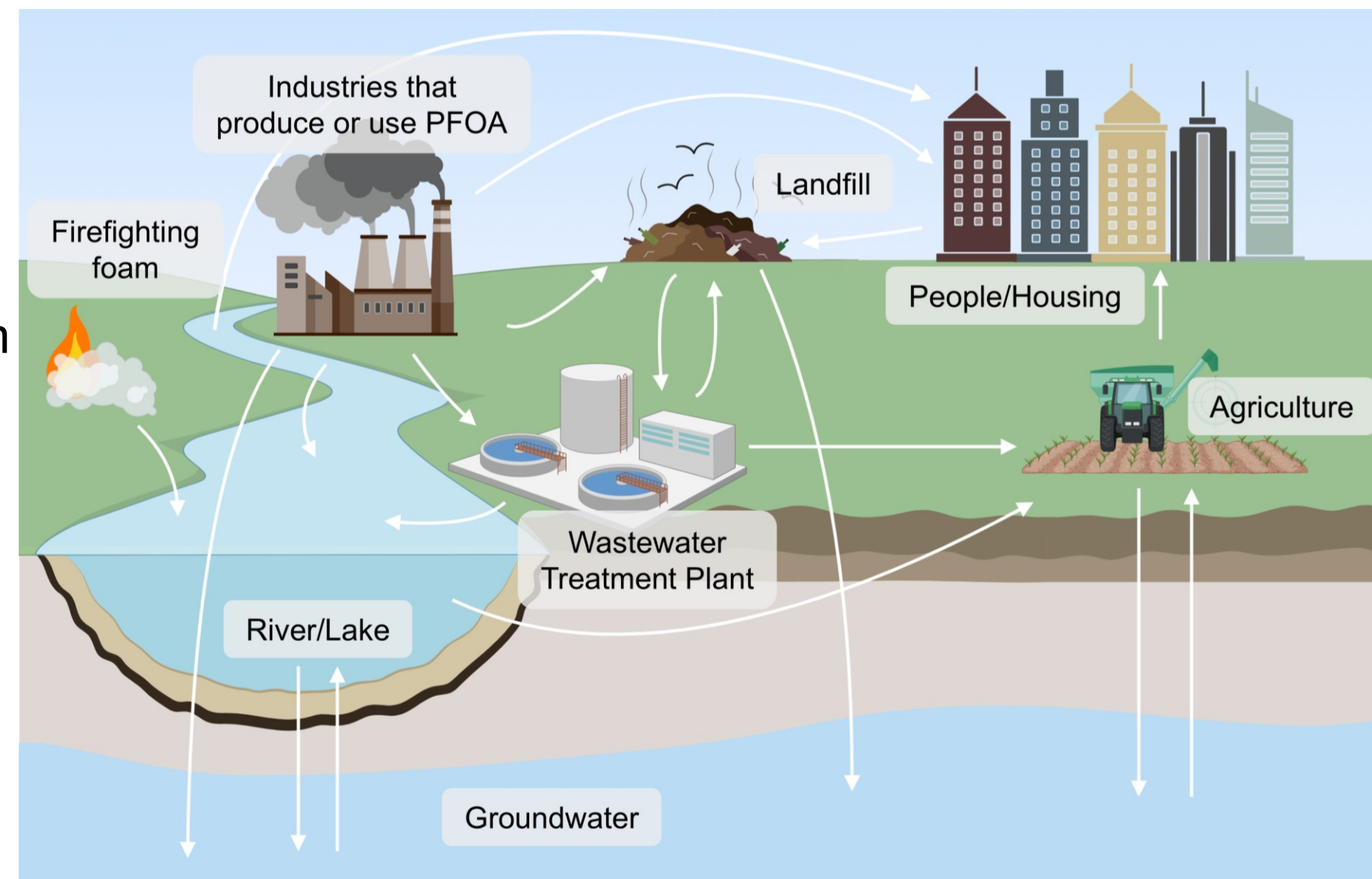
### 1. What are “Forever Chemicals”?

Per- and polyfluoroalkyl substances (PFAS), known as “forever chemicals,” are widely used in modern products because of their non-stick and water-repellent performance. However, their extreme persistence leads to long-term environmental accumulation.



Over time, these chemicals bioaccumulate in wildlife and humans, where chronic exposure is linked to **immune, metabolic, and cancer-related risks**.<sup>1</sup>

### 2. How do forever chemicals spread in water systems?



Forever chemicals such as PFOA enter water systems via industrial use, landfill leachate and wastewater, then recirculate through rivers and groundwater.

**PFAS contamination is widespread across UK water systems.**<sup>2</sup>

**88%** of surface waters contain PFAS

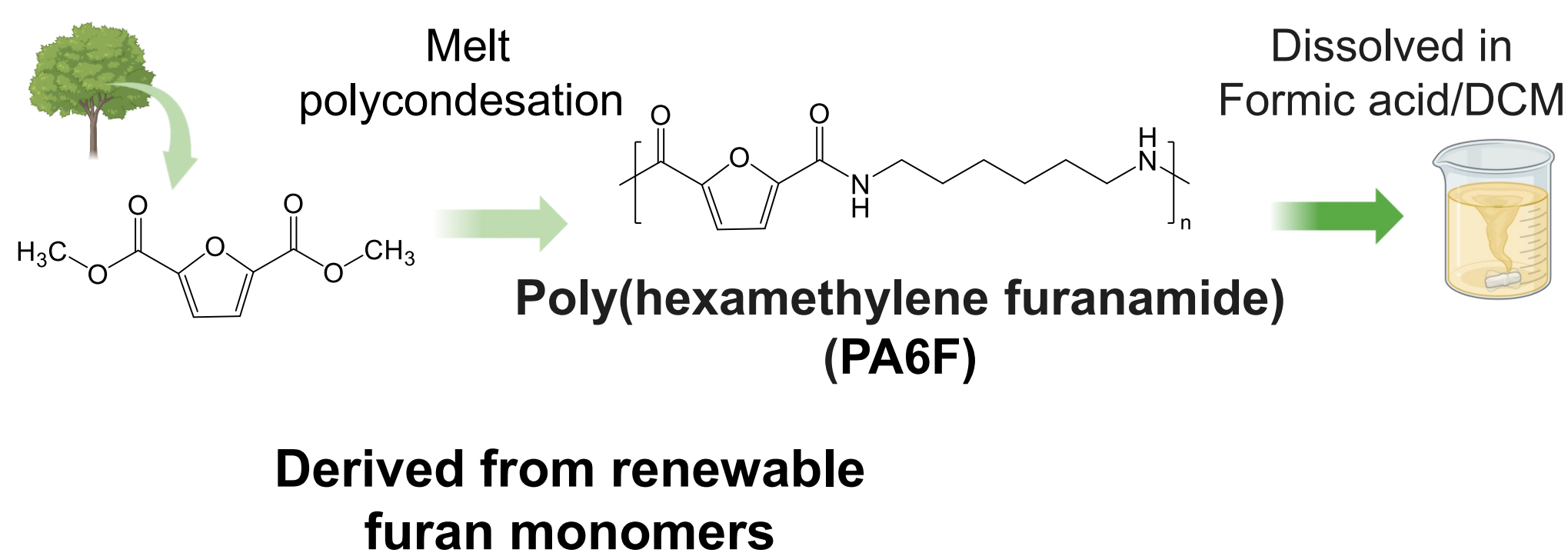
**46%** of groundwater contains PFAS

**94%** English waters tested exceed proposed safety limits

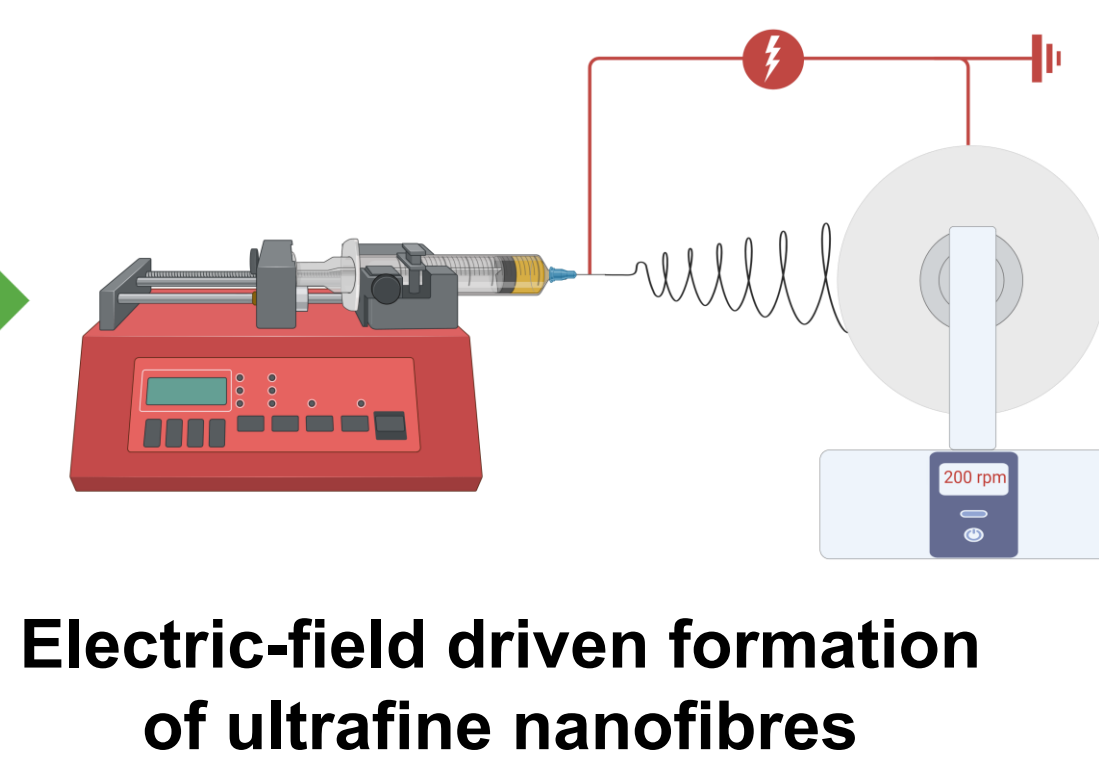
**We aim to design a high-efficiency, sustainable material platform for PFOA water remediation.**

## Our Approach

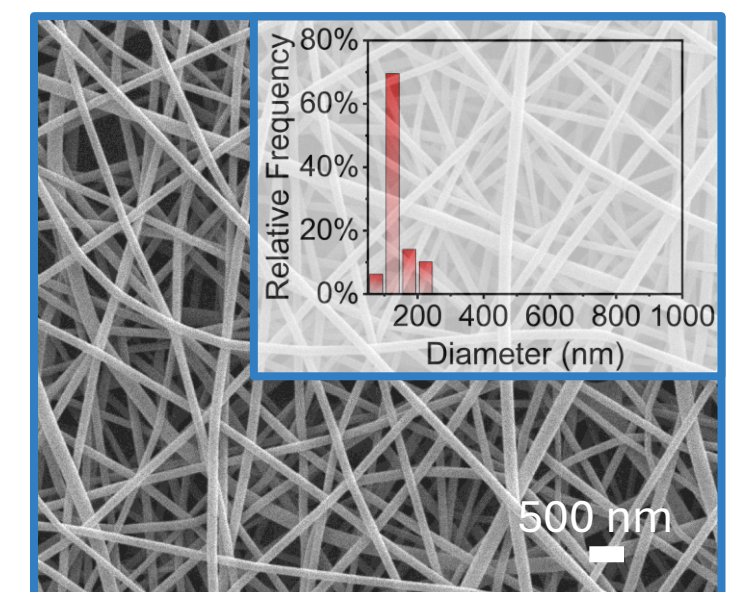
### 1. Bio-based Polyamide (PA6F) Synthesis<sup>3,4</sup>



### 2. Electrospinning into nanofibres<sup>5</sup>

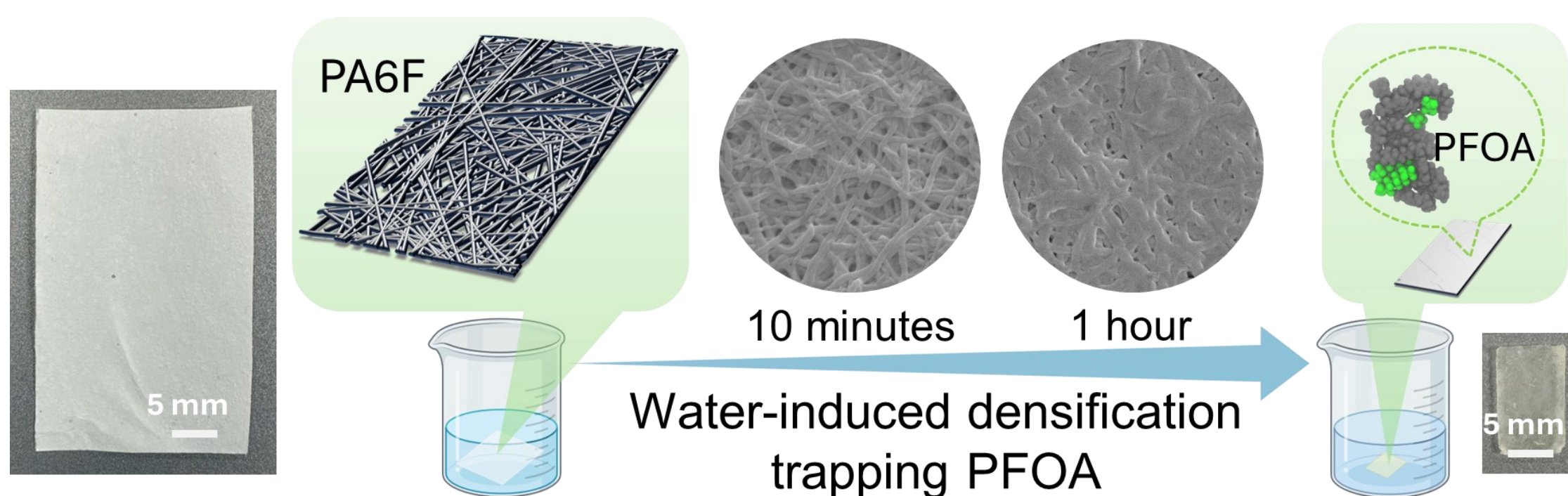


### 3. PA6F membrane



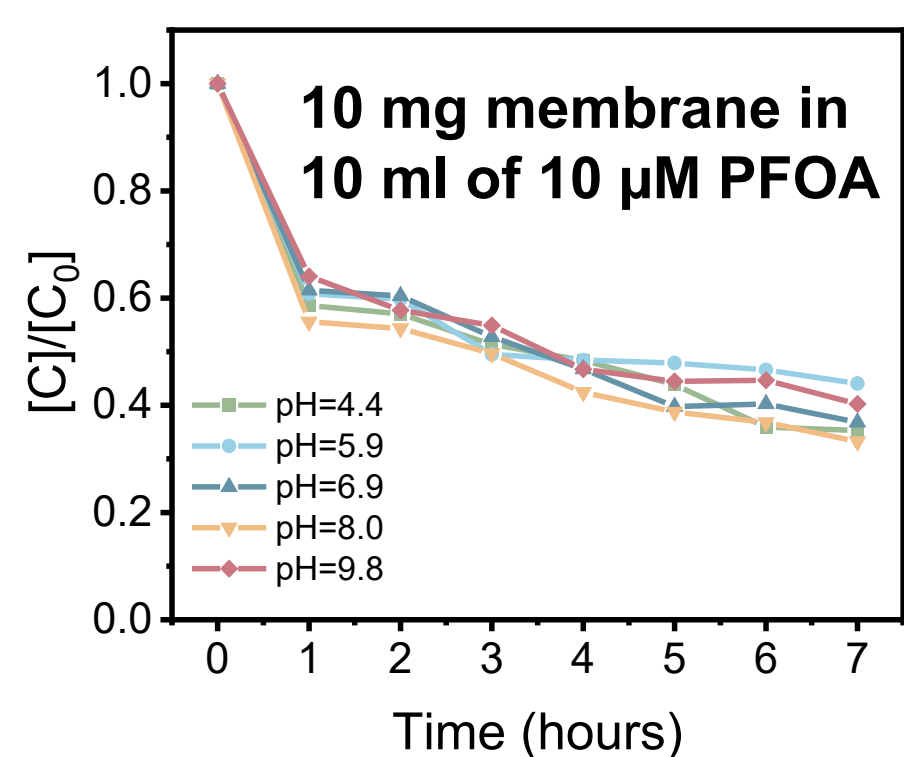
## Our Findings

### 1. Water-Induced Densification Enhances PFOA Capture



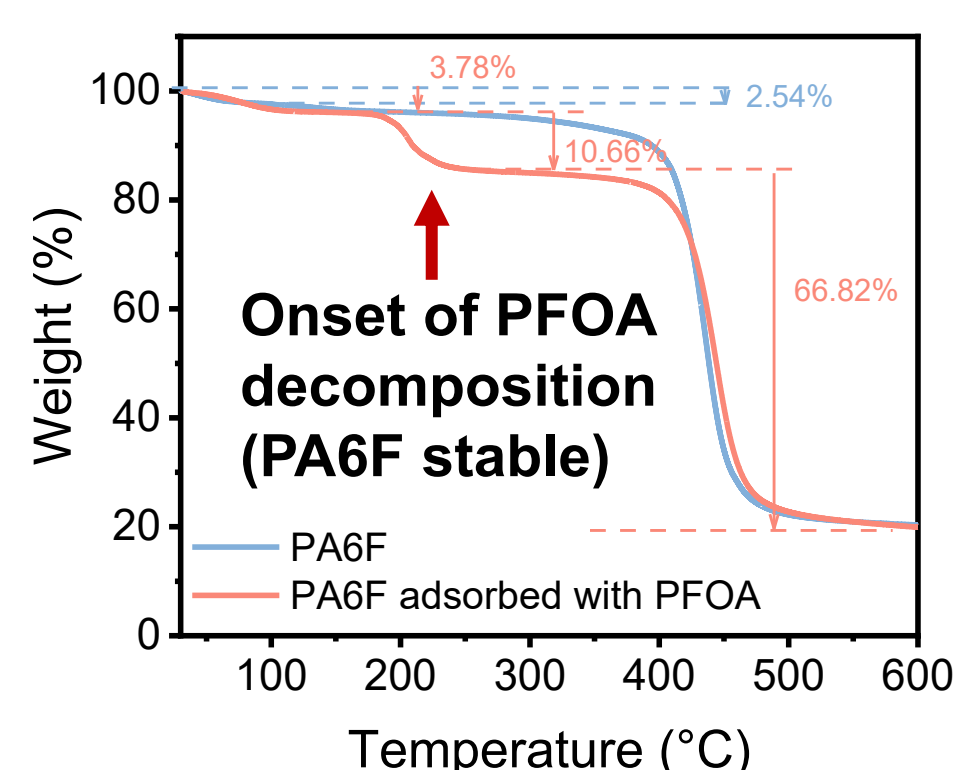
Upon contact with water, the PA6F nanofibres swell, leading to overall membrane densification that traps the target pollutant within the fibre network.

### 2. High-Efficiency PFOA Removal

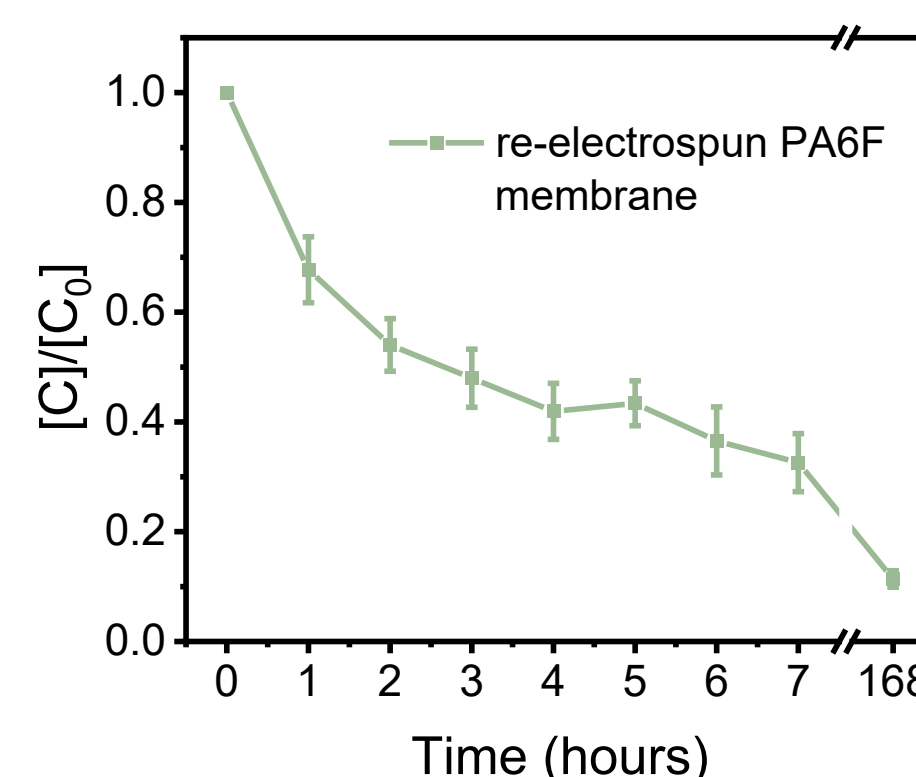


- Effective across a wide pH range.
- Adsorption capacity: **3.92 mg g<sup>-1</sup>** under industrially relevant conditions
- **71%** removal within 7 hours.
- **94.6%** removal after 7 days.

### 3. Closed-Loop Regeneration



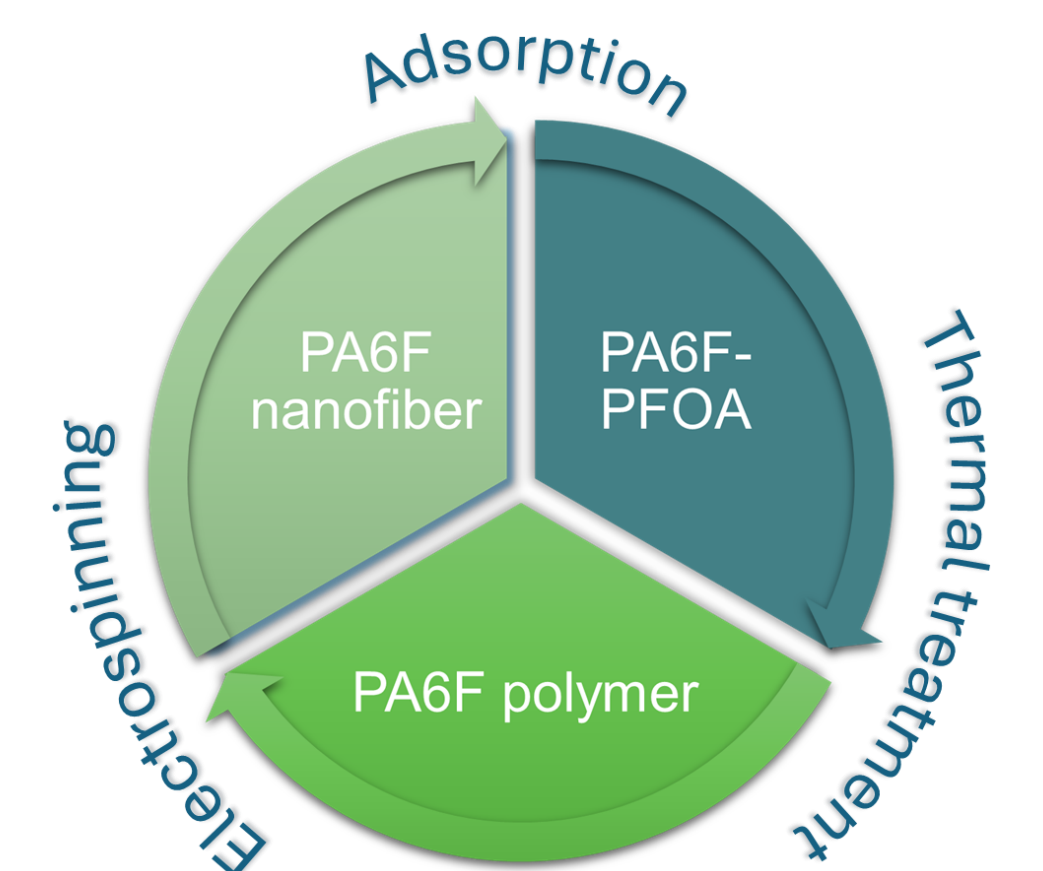
Thermal analysis confirms PFOA decomposition with preservation of the polymer structure.



Recovered polymer can be re-electrospun to form new membranes retaining **93%** of original adsorption capacity.

## Impact

- ✓ First sustainable semi-aromatic polyamide platform for PFOA water remediation.
- ✓ High-efficiency removal under industrially relevant conditions
- ✓ Water-triggered capture coupled with closed-loop material regeneration.



- ✓ Offers a regenerable alternative to conventional adsorption materials.
- ✓ Provides a scalable pathway for long-term PFAS mitigation in UK water systems.