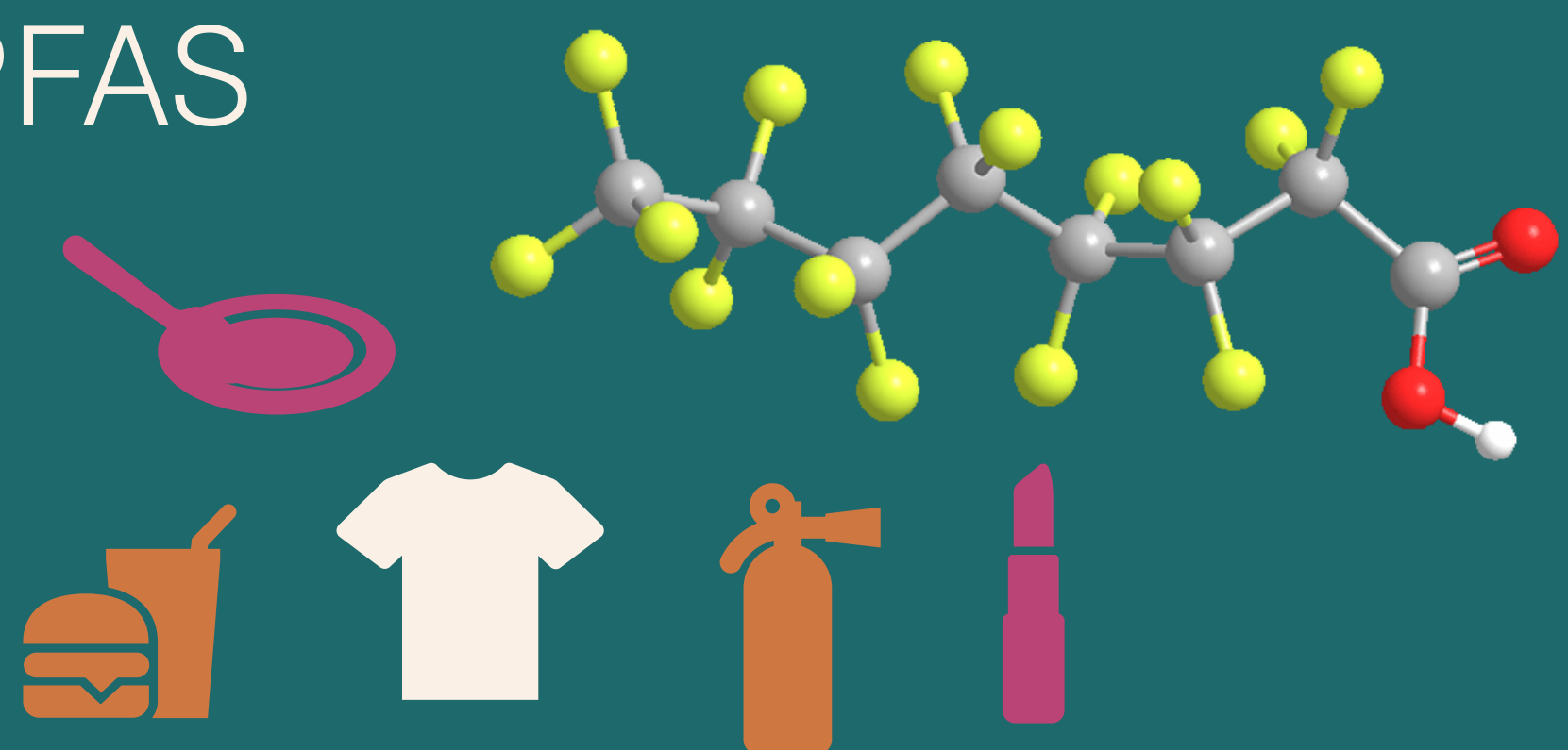


# Light-Initiated Continuous Flow Degradation of Per- or Polyfluoroalkyl Substances (PFAS)

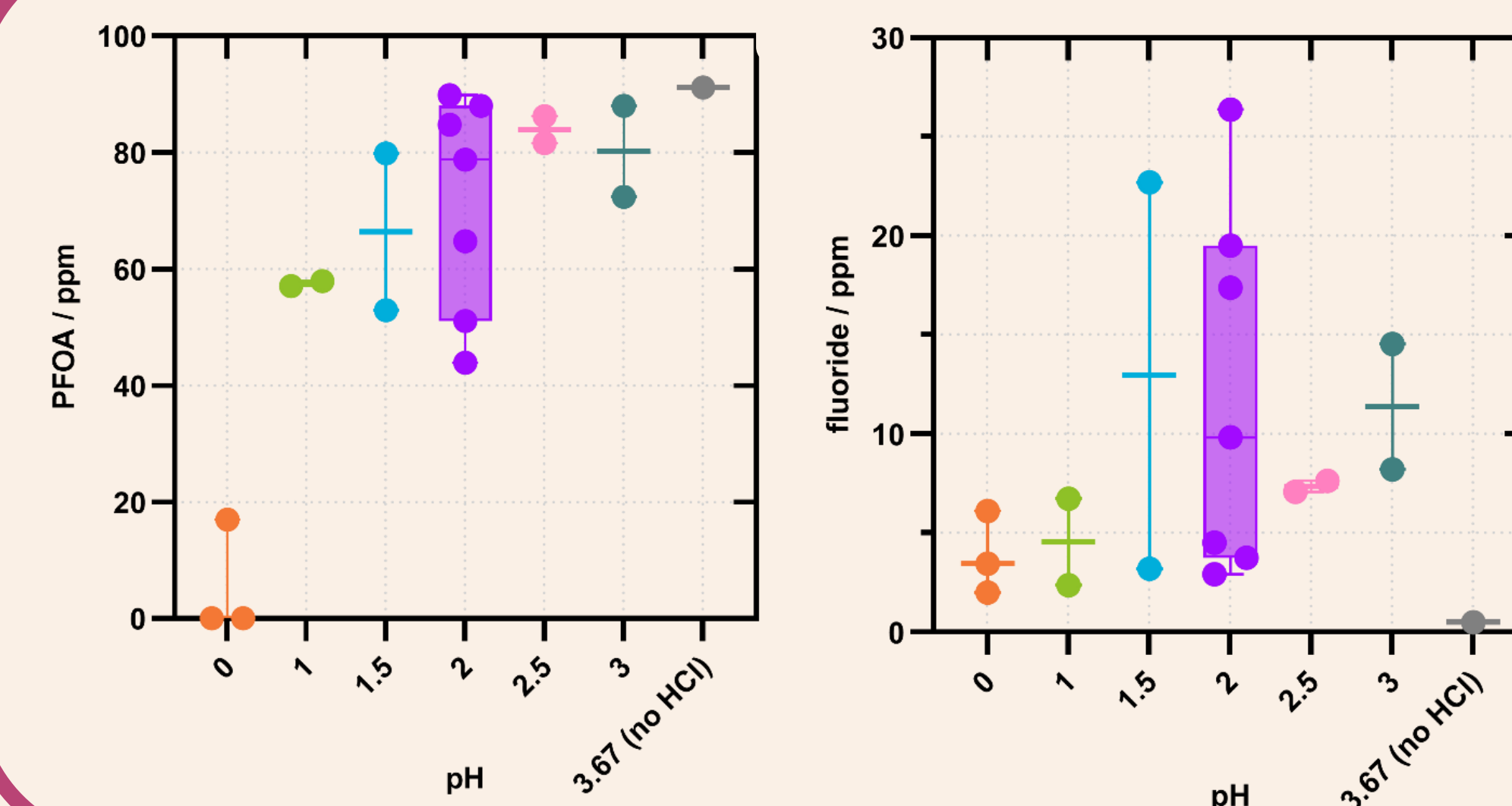
Rachael K. Matthews, Cameron J. Shearer

Chemistry Department, College of Sciences, Adelaide University, Australia

## PFAS



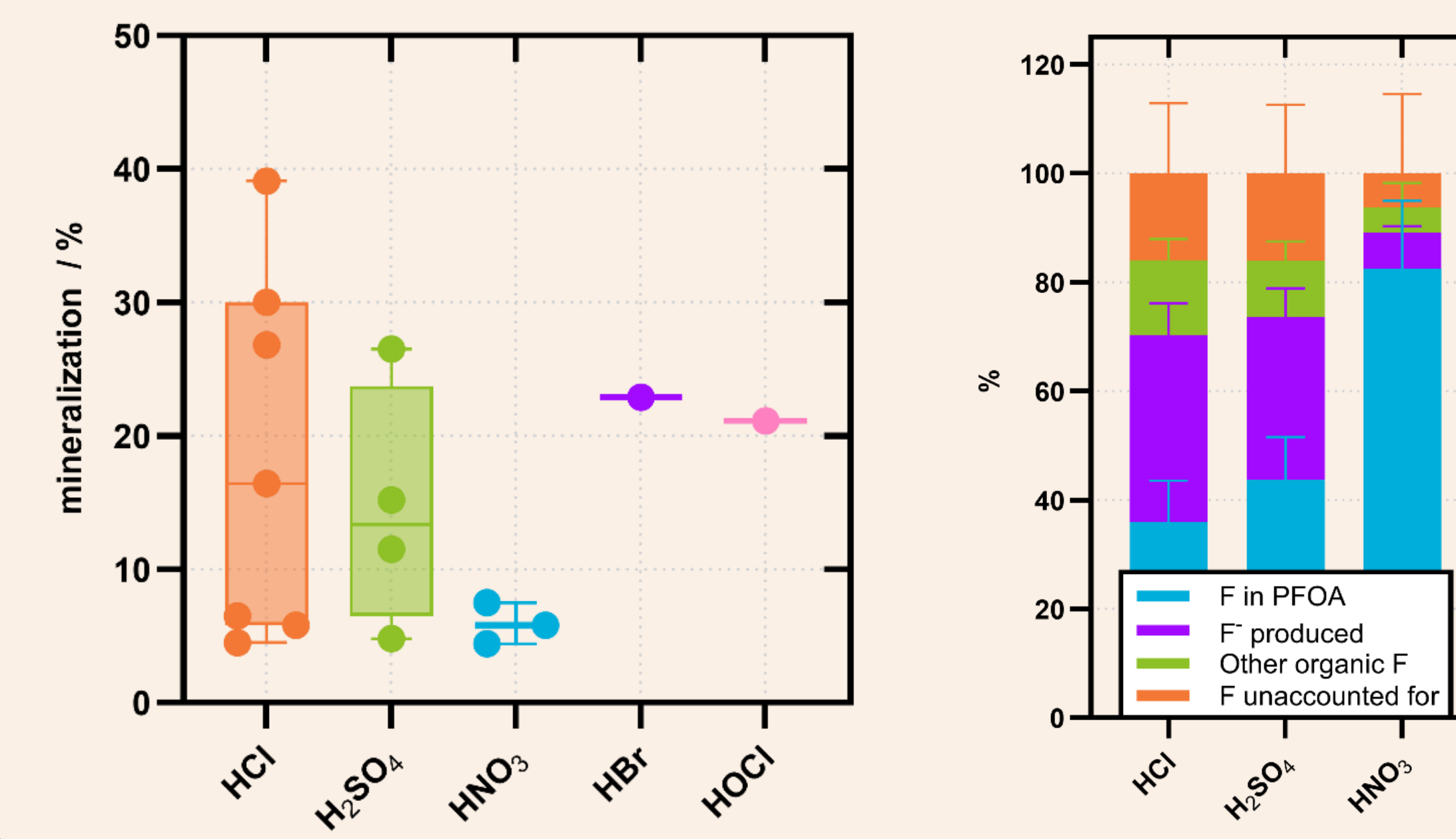
C-F bonds are resistant to biodegradation and current chemical destruction



## Photolysis at low pH

27 ppm F<sup>-</sup> can be produced at pH < 3

Conditions: [PFOA]<sub>0</sub> = 100 ppm, batch, 2 mL, 275 nm UV LED array (40-50 mW/cm<sup>2</sup>), HCl, 24 h, n = 1-7  
Analysis: F NMR, F-ISE, LC-HRMS



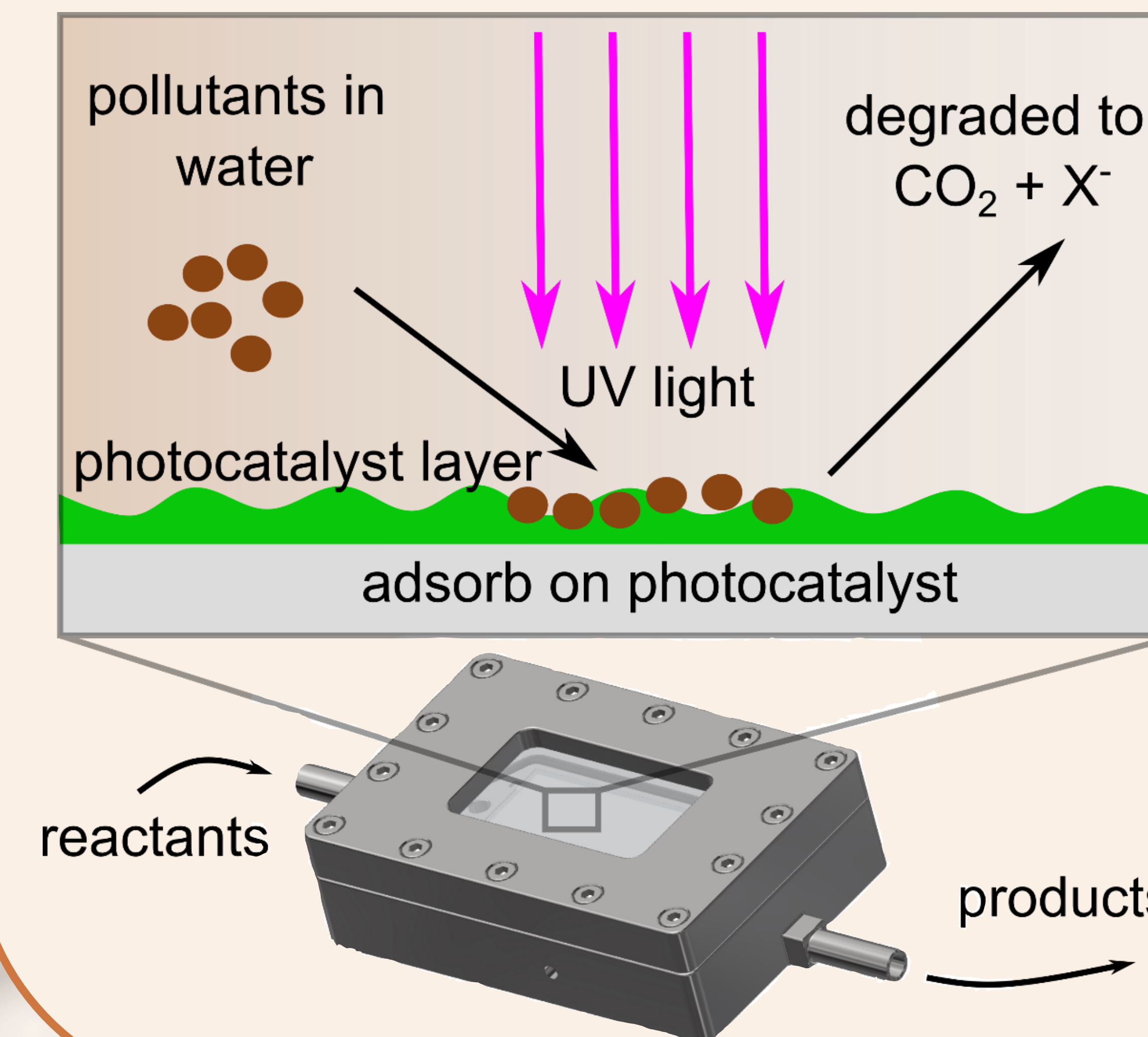
Conditions: [PFOA]<sub>0</sub> = 100 ppm, batch, 2 mL, 275 nm UV LED array (40-50 mW/cm<sup>2</sup>), 24 h, n = 1-7  
Analysis: F NMR, F-ISE, LC-HRMS

HCl, H<sub>2</sub>SO<sub>4</sub>, HBr & HOCl are capable of acid-mediated photolysis, but HNO<sub>3</sub> inhibits F<sup>-</sup> production

Other organic F is produced (e.g. short-chain PFAS), and some F is left unaccounted for

## Other acids & F mass balance

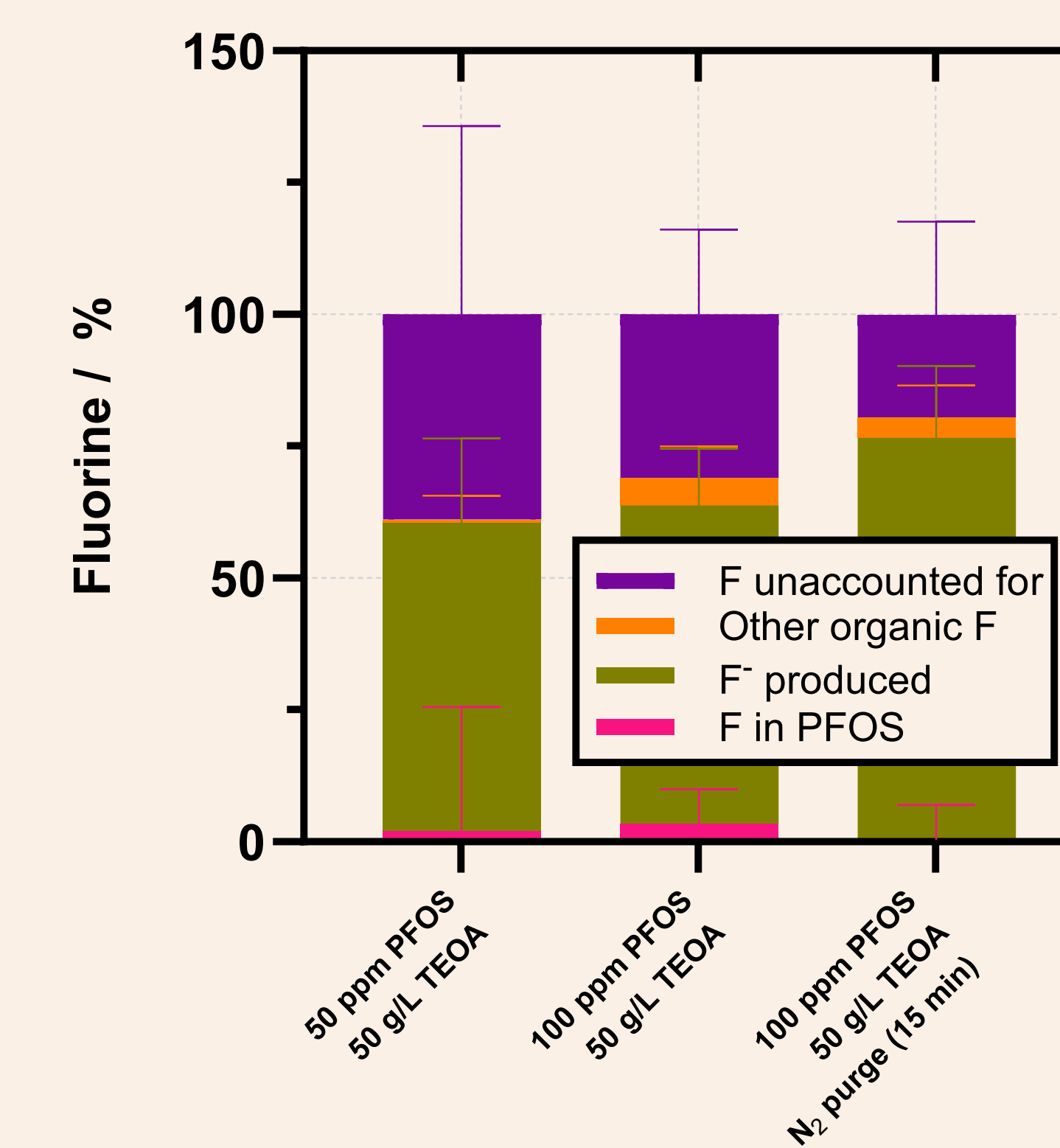
## Continuous circulating flow



## Photoreduction of PFOS

F<sup>-</sup> production only observed in presence of triethanolamine (hole scavenger)

100 % PFOS conversion, 75 % mineralization



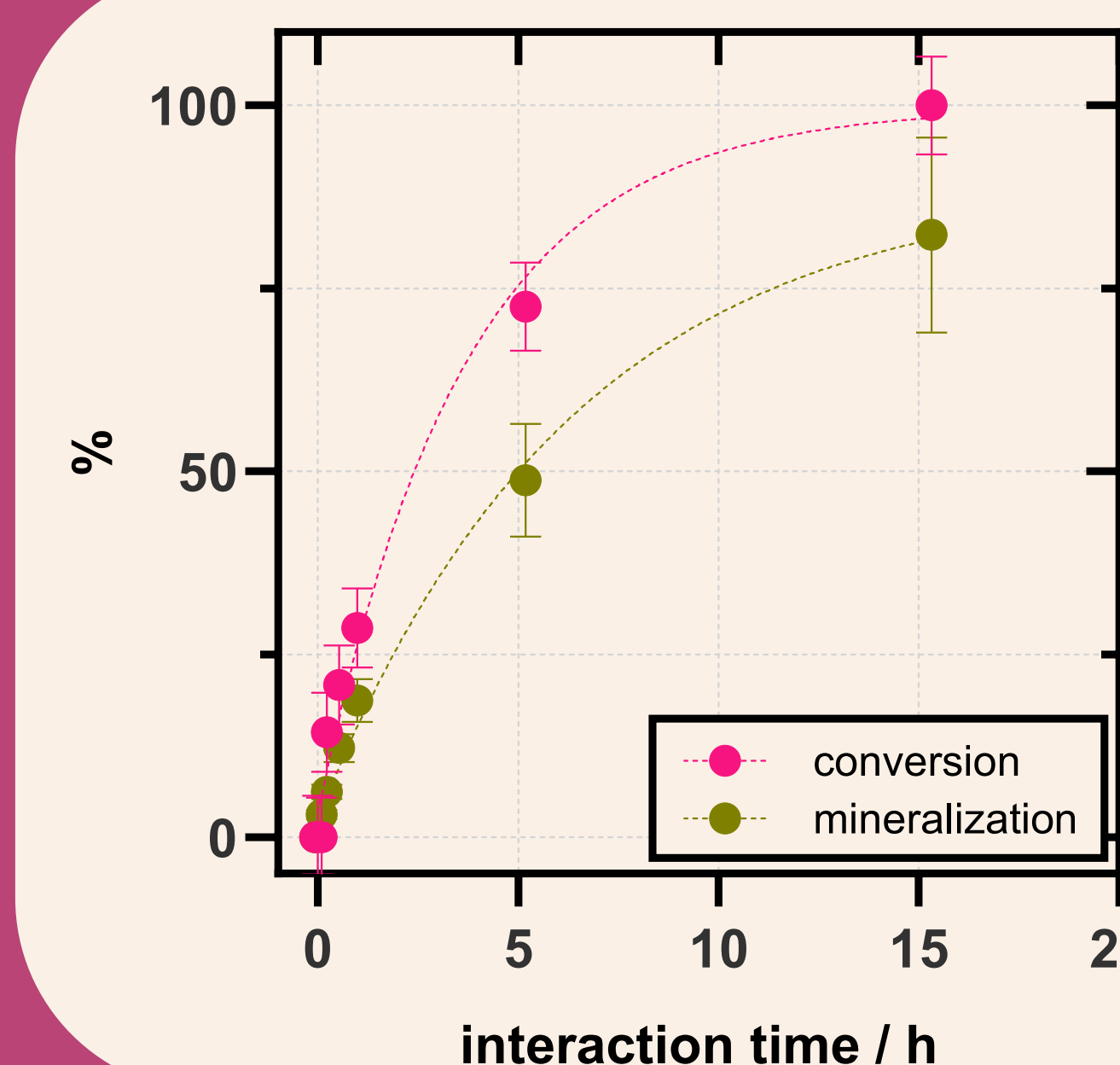
Conditions: [PFOS]<sub>0</sub> = 50 or 100 ppm, batch, 2 mL, 365 nm UV LED array (510 mW/cm<sup>2</sup>), hole scavenger (TEOA), 24 h, n = 1  
Analysis: F NMR, F-ISE, LC-HRMS

## Mineralization under flow conditions

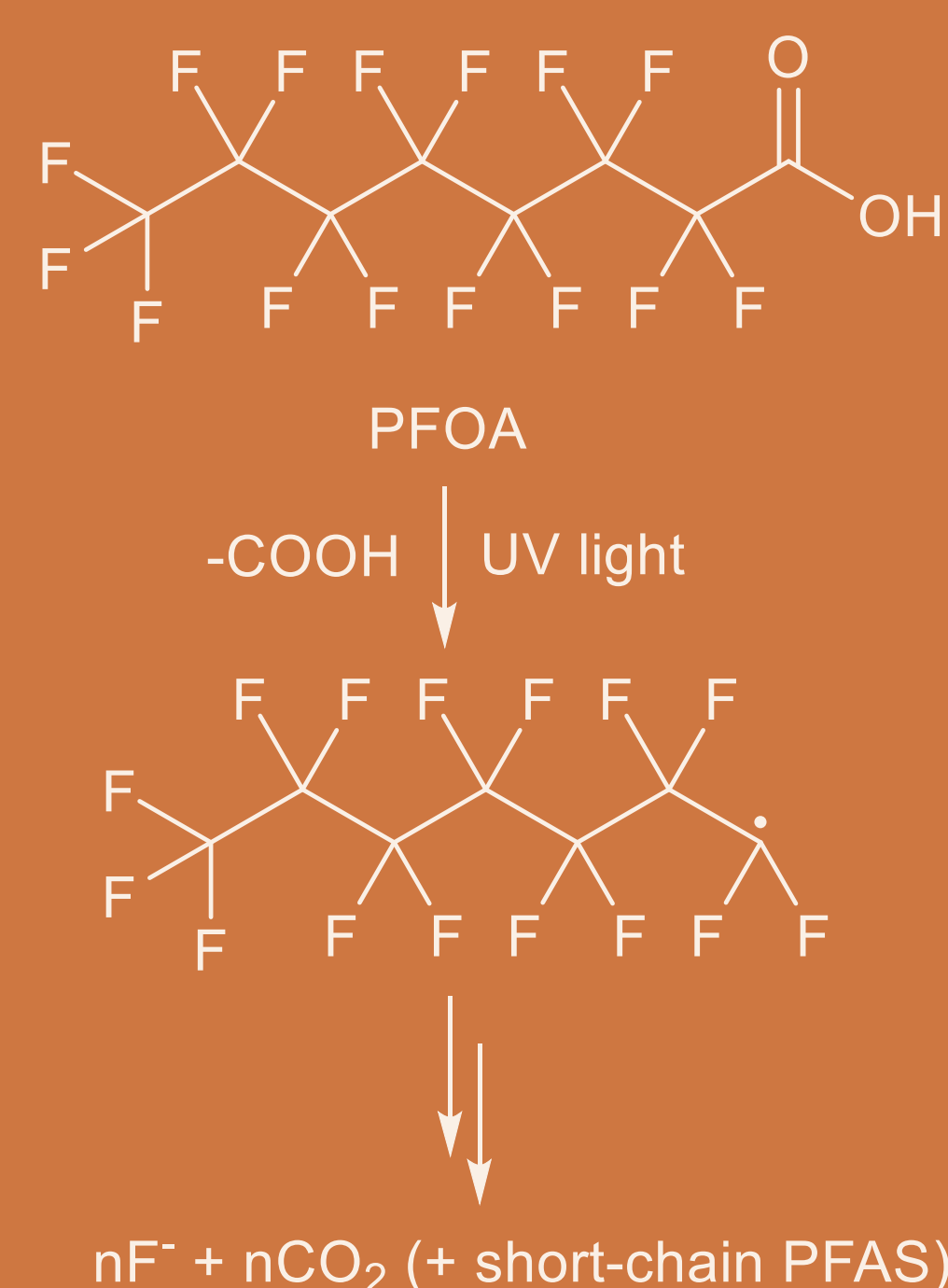
Photocatalytic reduction of PFOS demonstrated in continuous circulating flow system

> 80 % PFOS mineralization observed

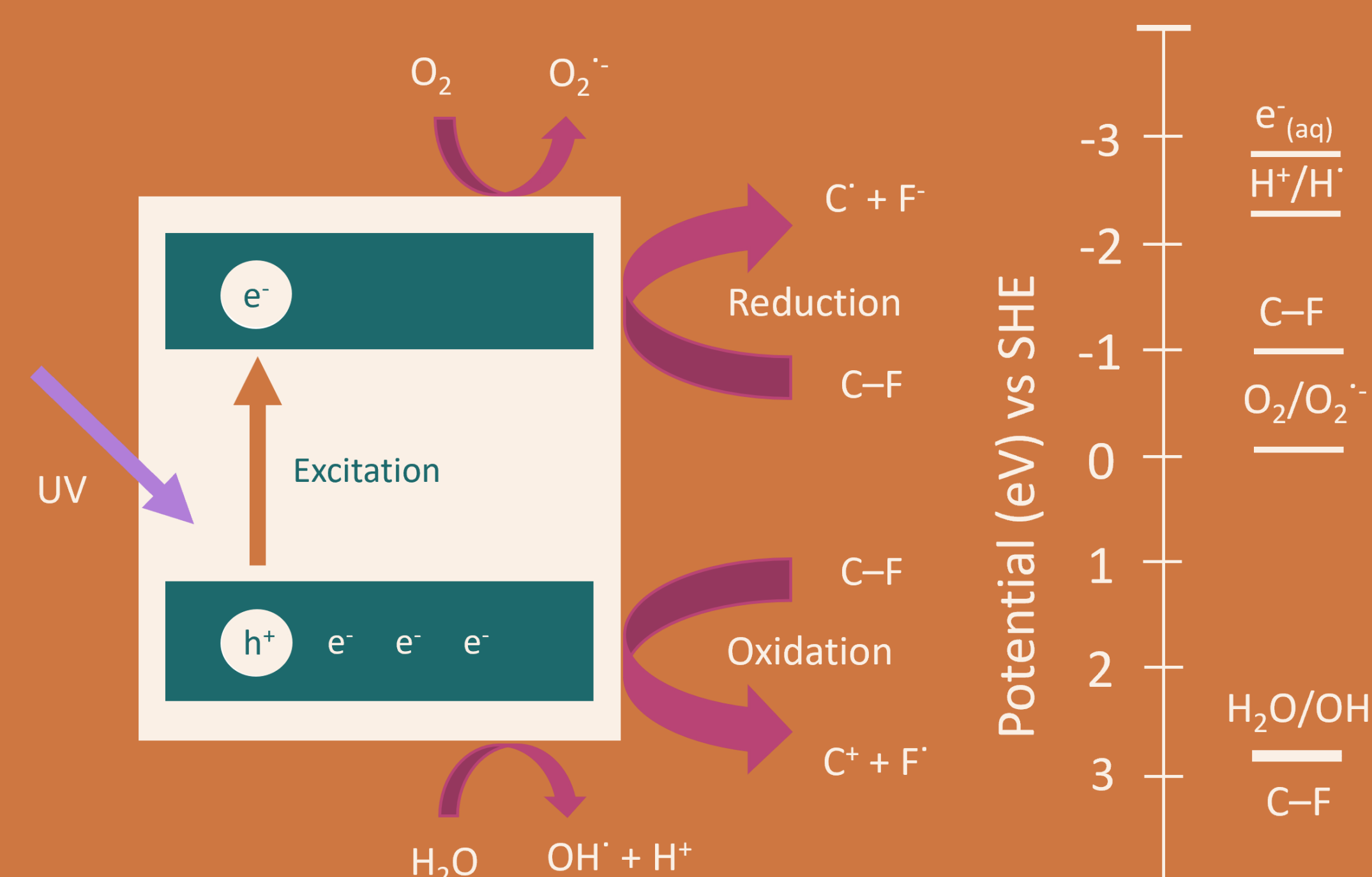
Conditions: [PFOS]<sub>0</sub> = 100 ppm, flow, 10 mL, 365 nm UV LED array (764 mW/cm<sup>2</sup>), 48 h circulation, 15.3 h interaction, n = 1  
Analysis: F NMR, F-ISE



## Photolysis



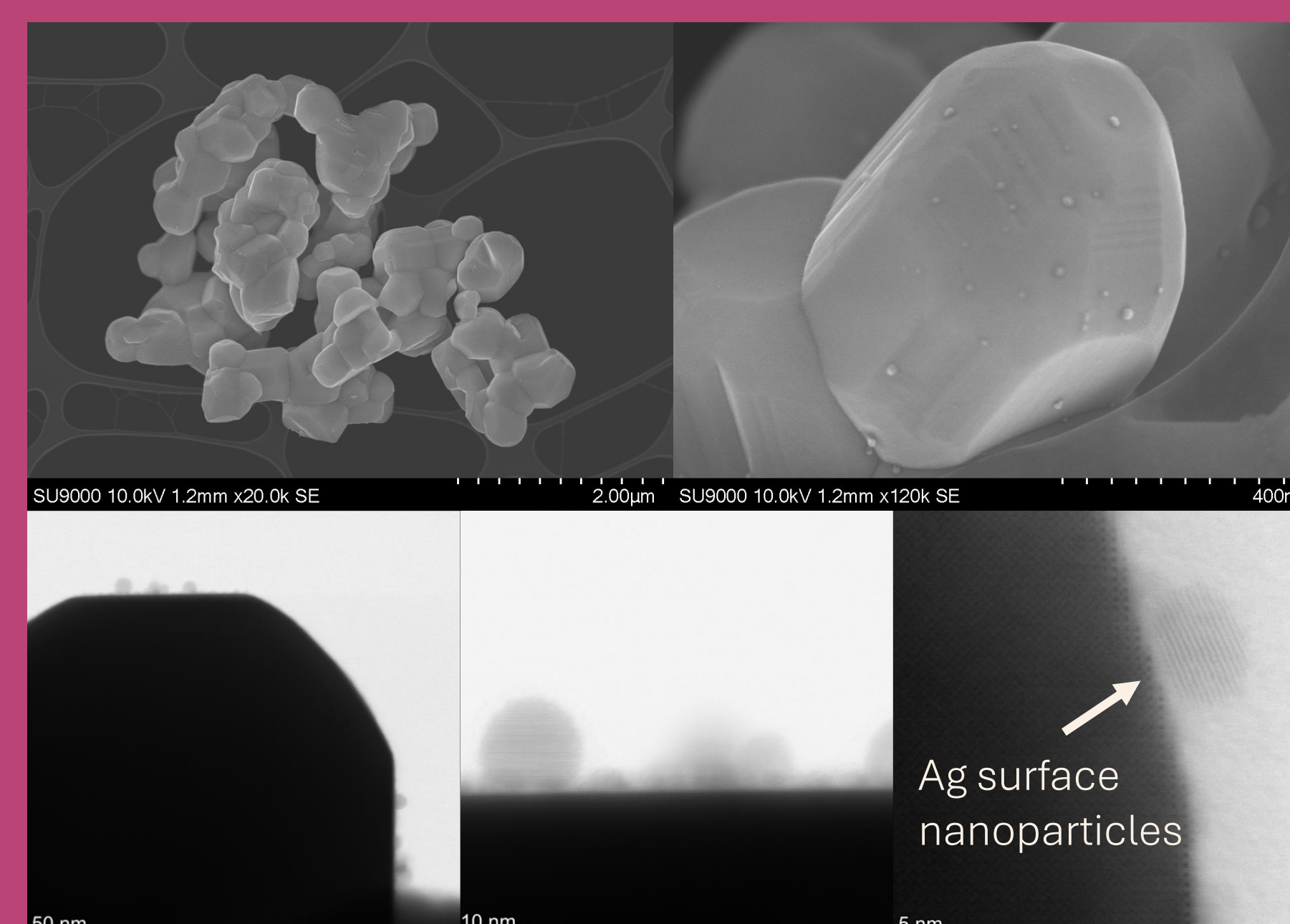
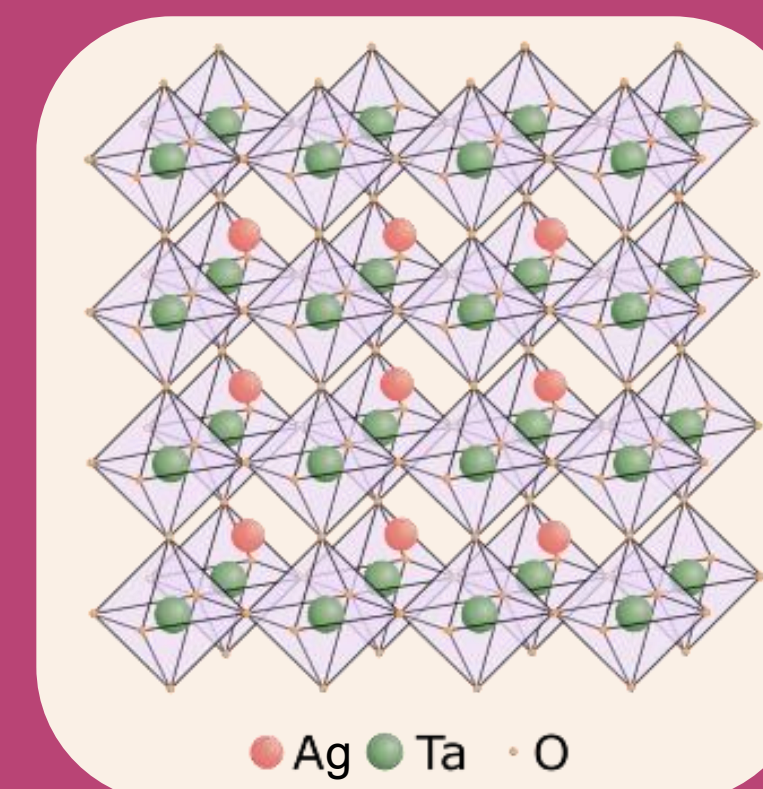
## Photocatalysis



Self-cleaning surfaces, water purification, air sterilization and green hydrogen production are current examples of photolysis and photocatalysis

## AgTaO<sub>3</sub>

AgTaO<sub>3</sub> metal oxides have a 3.4 eV bandgap which is sufficient for C-F bond reduction



Matthews et. al. Chem. Mater. 2025.

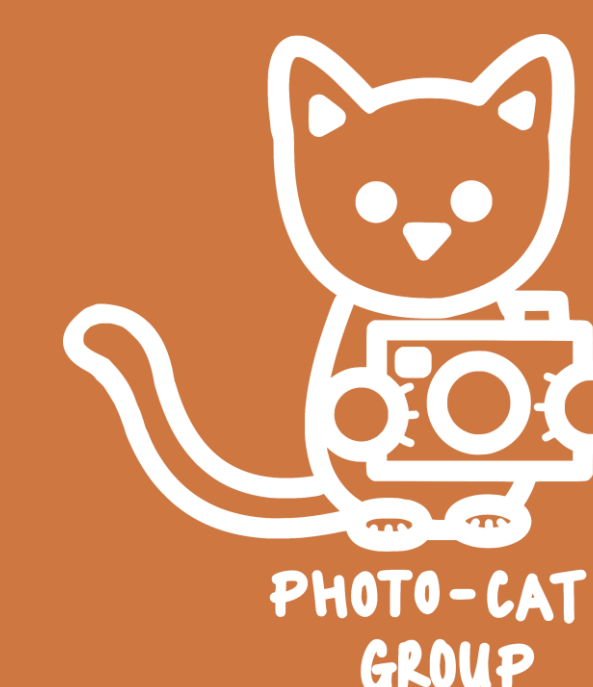
Matthews et. al. Colloids Surf. A Physicochem. Eng. Asp. 2026.

Hamza et. al. Small 2025.

Toyota et. al. ACS Appl. Nano Mater. 2026.

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