

PFAS: forever chemicals?!

- Per- or polyfluoroalkyl substances (PFAS) e.g., PFOS are known as forever chemicals.

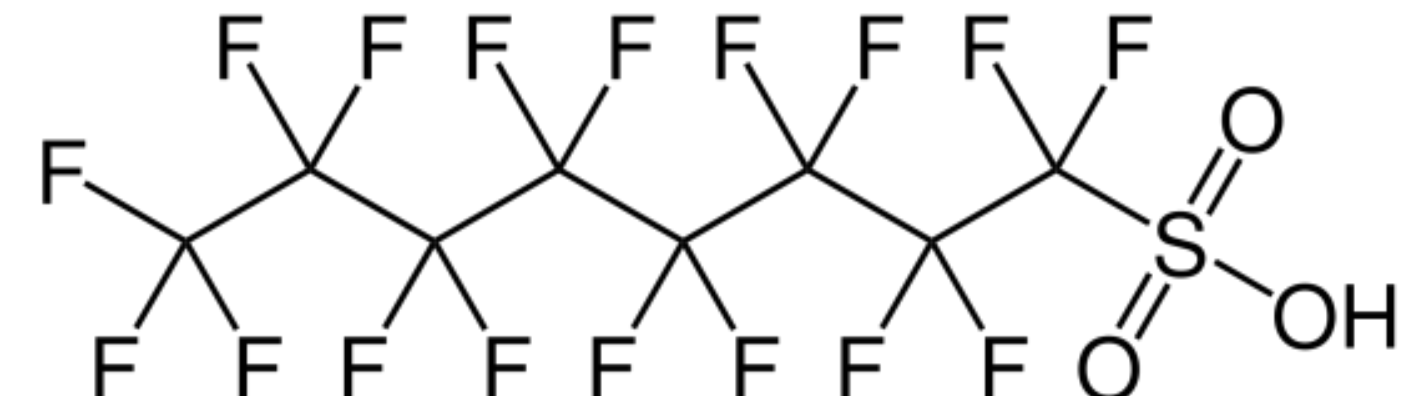


Fig.1 Chemical structure perfluorooctane sulfonate (PFOS).

- PFAS are persistent to degradation by traditional methods owing to the presence of C-F bonds (the strongest bonds in nature).
- PFAS are bio-accumulative, toxic, and cause severe effects on the human health and environment. PFAS are everywhere now.
- Finding an efficient degradation route is unavoidable as per the **SDG 6 (especially target 6.3)** to ensure access to clean water and sanitation for all, reducing water pollution, and eliminating pollutants.



Photocatalysis

- Efficient
- Eco-friendly
- Low cost

- Oxidative degradation *via* direct oxidation or oxidation with hydroxyl radicals didn't achieve PFAS mineralization.
- Reduction pathways *via* direct electron transfer reduction or solvated electrons with higher reduction potential showed efficient PFAS mineralization
- CdIn₂S₄ is a visible-light active photocatalyst ($E_g=2.4$ eV) and higher reduction potential of -0.9 V vs. NHE compared to -0.3 V in TiO₂.

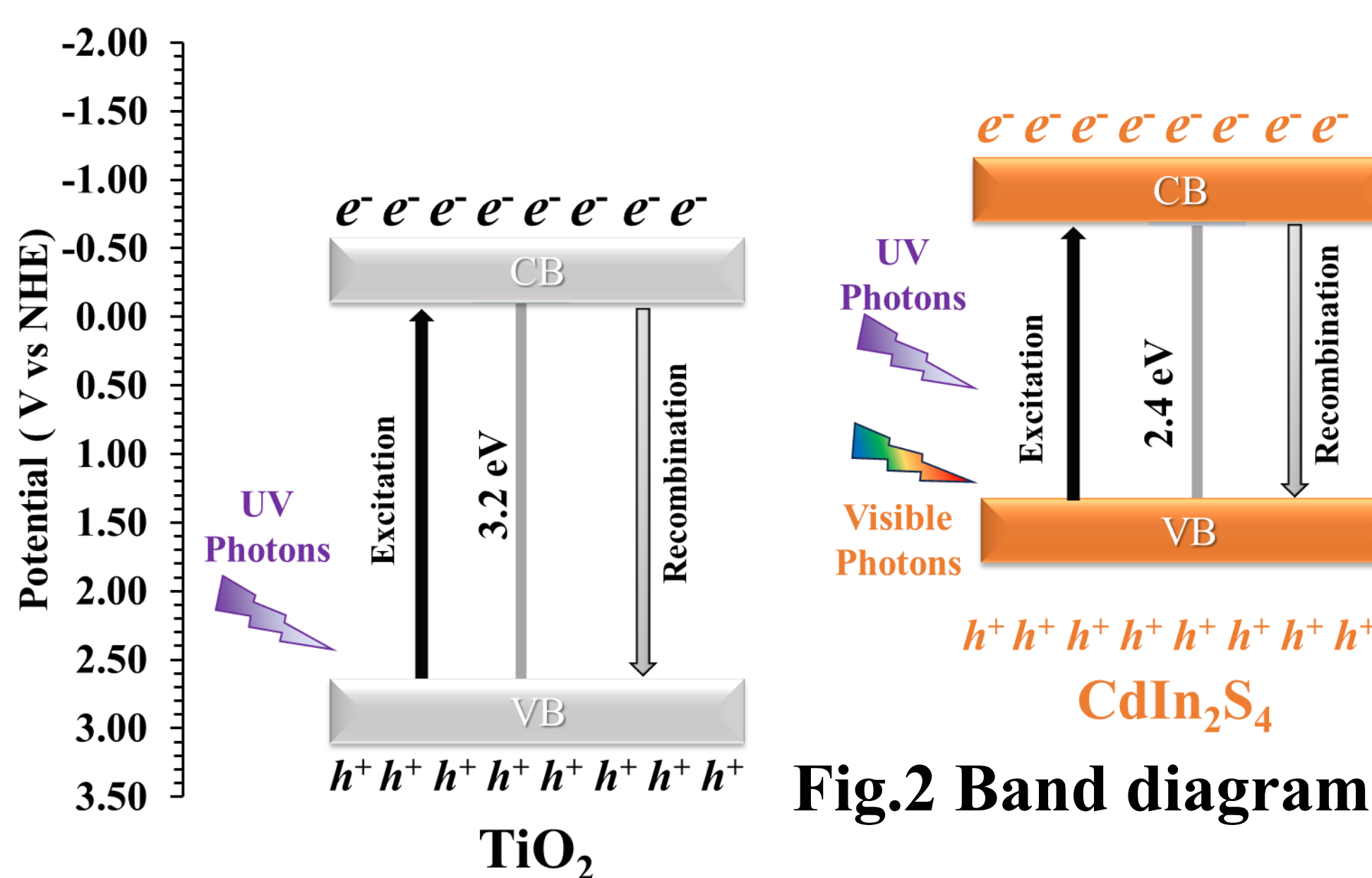


Fig.2 Band diagram of CdIn₂S₄ compared to TiO₂.

**Research question:
Can CdIn₂S₄ achieve
efficient
photodegradation of
PFAS?!**

Catalyst Synthesis & Characterizations

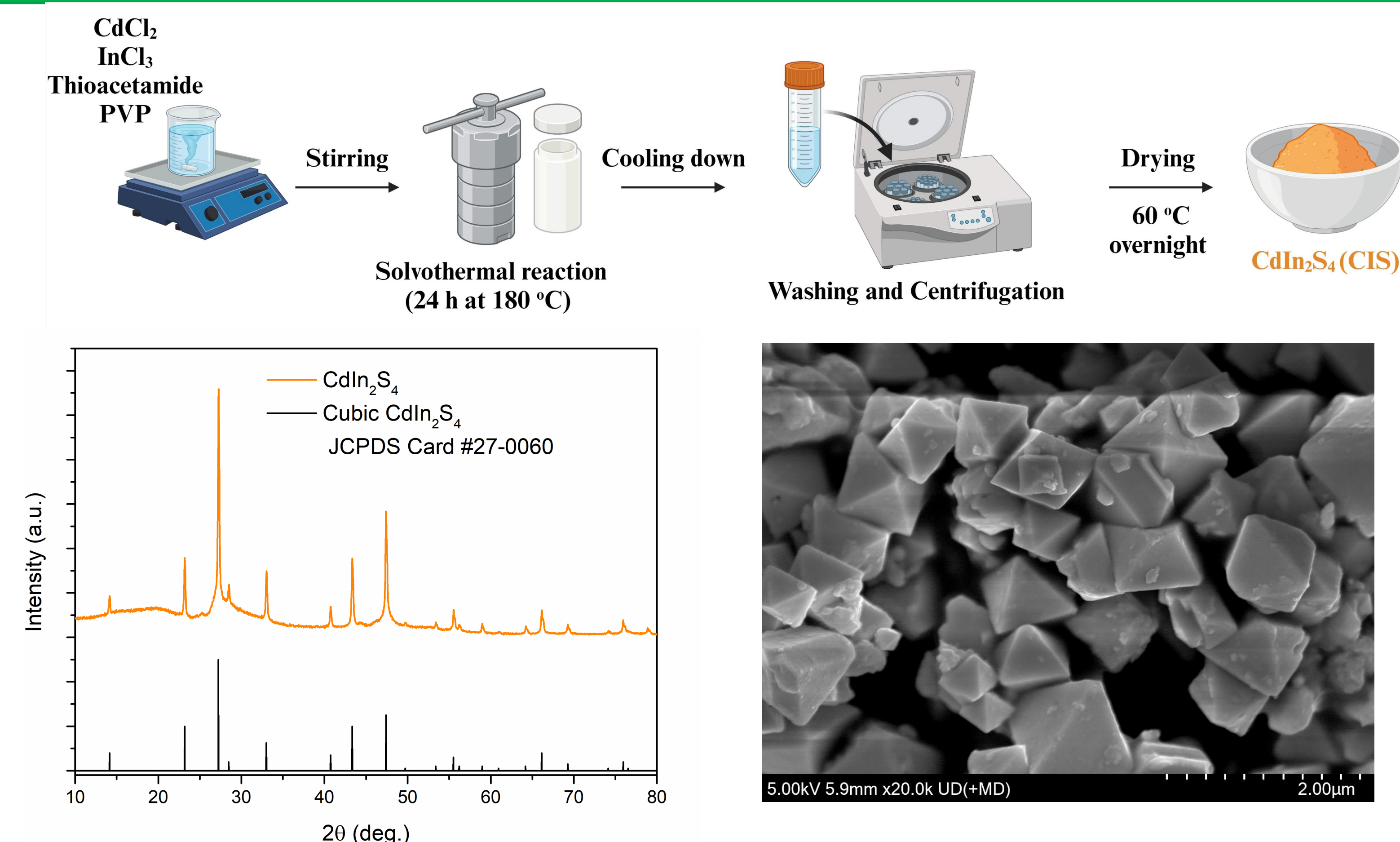
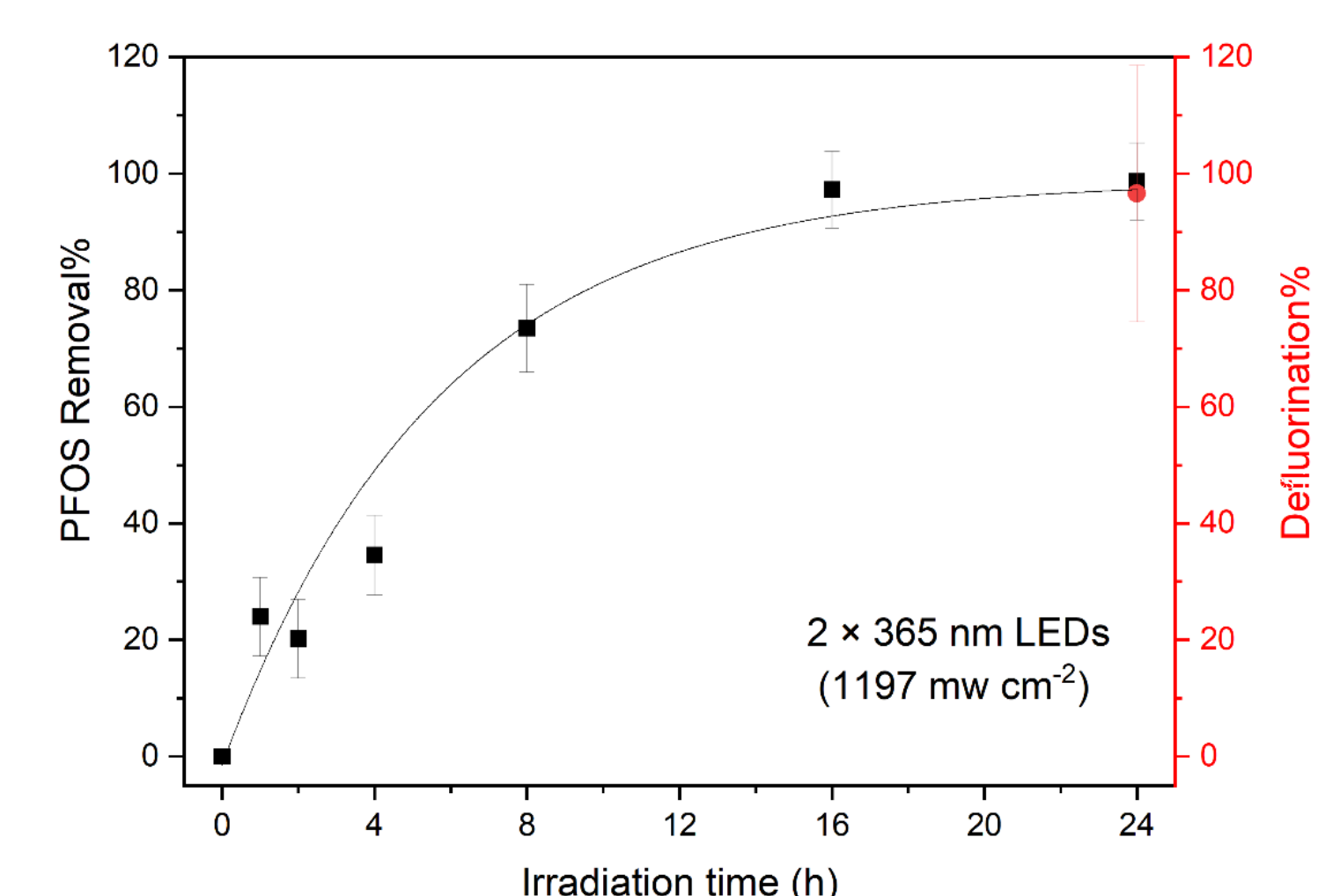


Fig. 3 Schematic illustration of the facile solvothermal synthesis of CdIn₂S₄ (CIS), XRD pattern, and SEM images of CIS micro-pyramids.

Successful facile synthesis of CIS micro-pyramids

PFOS photodegradation



**CIS achieved 100% PFOS photodegradation
and mineralization in 24 h**



Fig. 4 Schematic illustration of the experimental setup of the photocatalytic degradation of PFOS using CIS and the corresponding PFOS removal% and defluorination%.

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CdIn₂S₄ vs TiO₂ and vs. Field-derived PFAS sample

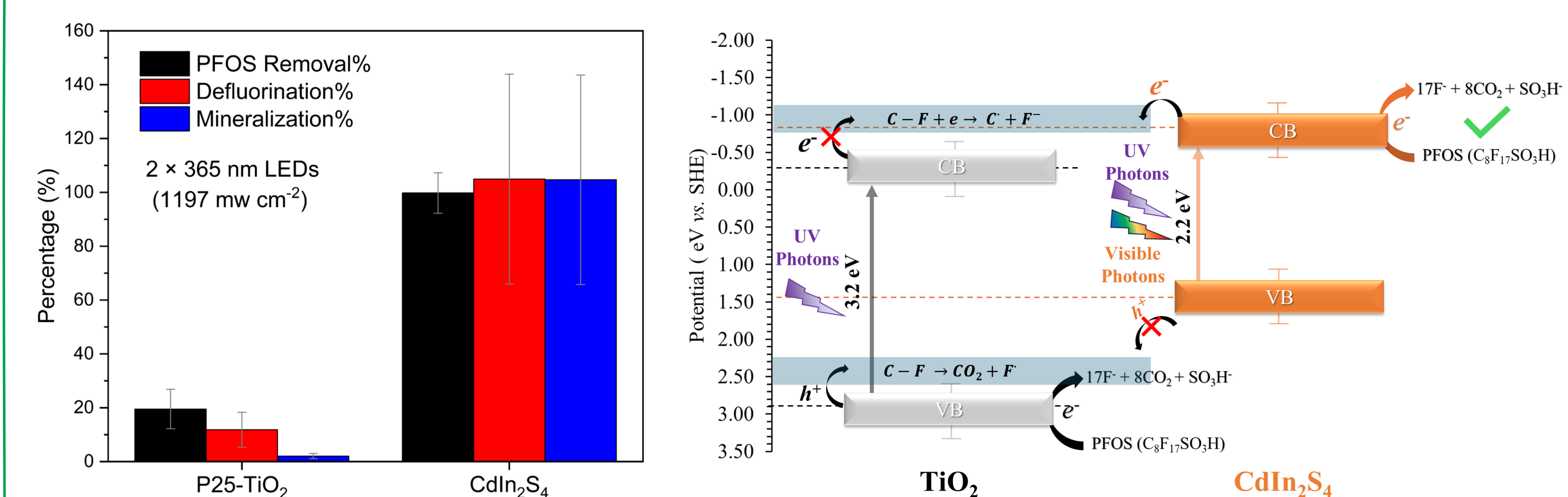


Fig. 5 Comparison of the photocatalytic performance of TiO₂ and CdIn₂S₄ toward the PFOS removal%, defluorination% and mineralization%.

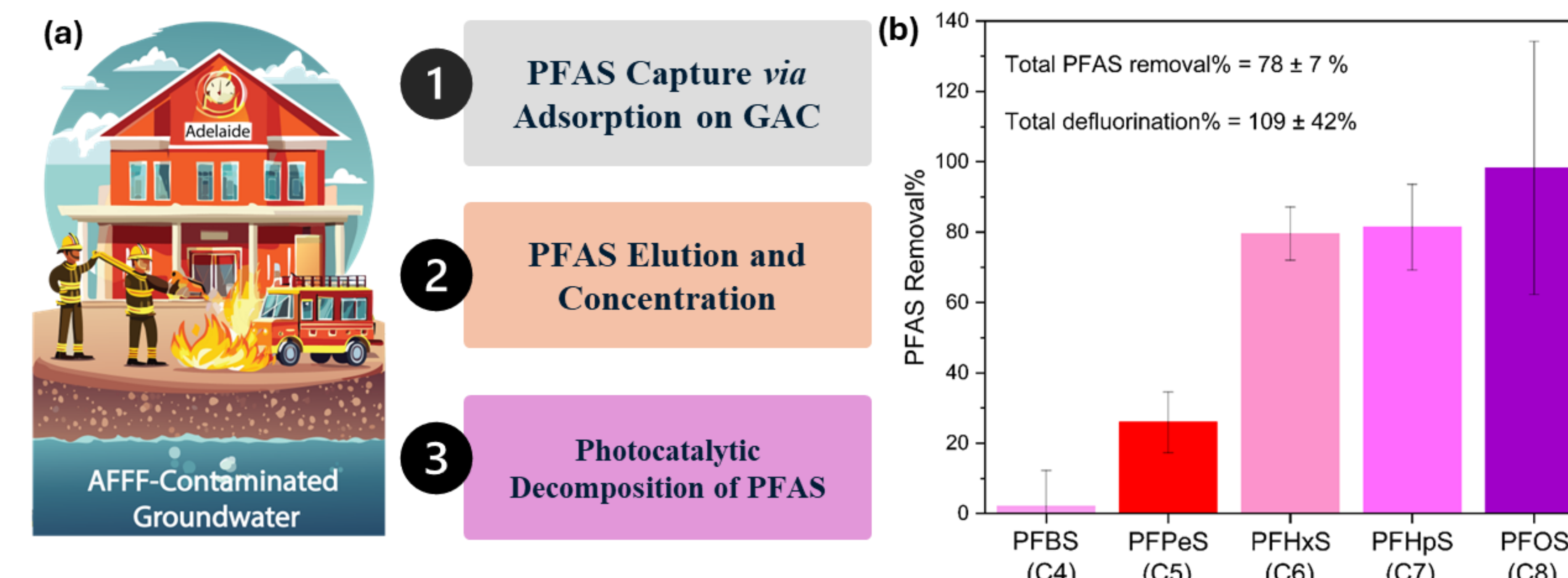


Fig. 6 Scheme of the treatment of the photodegradation of different PFAS in a field-derived PFAS sample collected from contaminated water using CdIn₂S₄ micro-pyramids.

CIS achieved out-perform TiO₂ and achieved ~100% mineralization of field-derived PFAS sample, ; PFAS are not forever chemicals

Outlook

- Enhancing the stability and activity toward PFAS degradation.
- Investigating other MIn₂S₄ toward the PFOS mineralization.

