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Visible light-induced decomposition of perfluoroalkyl substances by CdS/ZnS core/shell nanocrystals

Perfluoroalkyl substances (PFASs), such as perfluorooctanesulfonic acid (PFOS), have been extensively used in various industries due to their exceptional chemical and thermal stability. However, their remarkable stabilities also result in severe environmental persistence, posing significant challenges for their degradation. In our previous study, we demonstrated efficient PFOS decomposition under visible-light irradiation using cadmium sulfide nanocrystals (CdS NCs). Nevertheless, the leaching of cadmium ions into aqueous solutions significantly hinders their practical application.

To overcome this limitation, we synthesized CdS/ZnS core/shell nanocrystals (CdS/ZnS NCs) and evaluated their photocatalytic performance under 405 nm LED light (616 mW/cm²). Although the ZnS shell slightly reduced the defluorination efficiency from 80.1% to 75.5% after 48 hours, it successfully suppressed Cd²⁺ leaching by 93.5%. While a small amount of Zn²⁺ leaching was still observed, the overall stability of the catalyst was substantially improved. These findings highlight the potential of CdS/ZnS NCs as an efficient and environmentally benign platform for PFAS degradation under mild aqueous conditions.

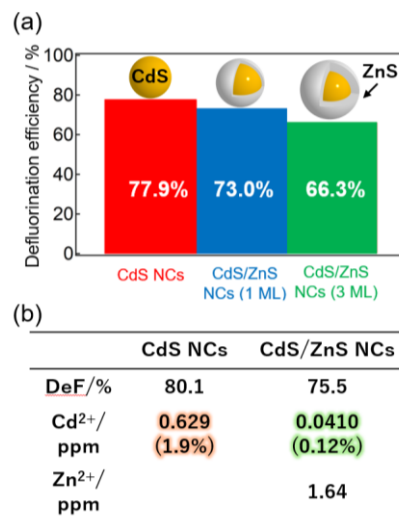


Fig. 1 (a) Defluorination efficiency of PFOS under 405 nm-light irradiation using CdS and CdS/ZnS NCs (1, 3 monolayers (ML)). (b) Leached ions after 48 hours of irradiation.

- 1) Y. Arima, Y. Okayasu, D. Yoshioka, Y. Nagai, Y. Kobayashi, *Angew. Chem. Int. Ed.* **63**, e202408687 (2024).