

Sustainable Microplastics Management: Capture, Upcycling and Utilization

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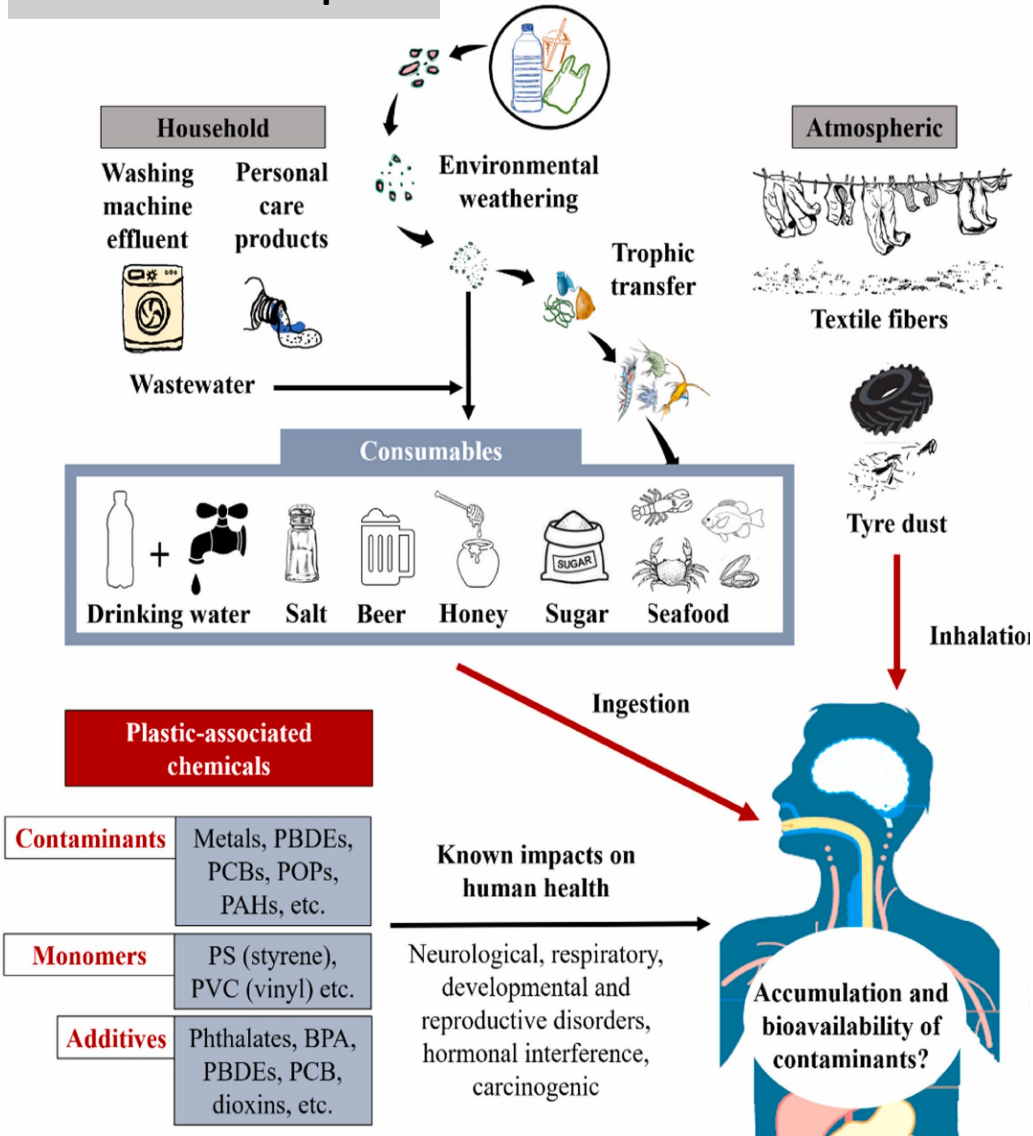
6 August 2024



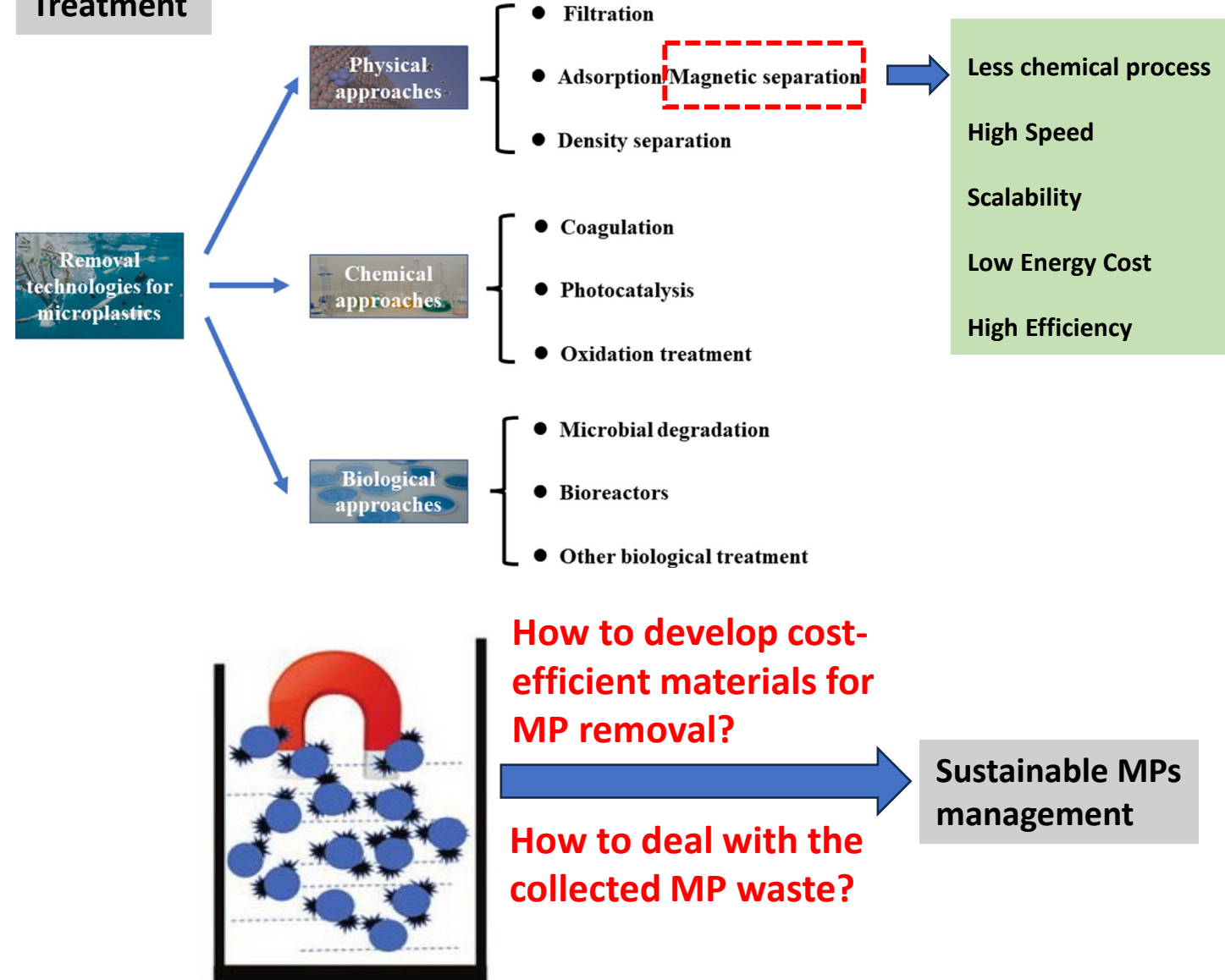
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Management of microplastics in contaminated water

Generation & Impacts

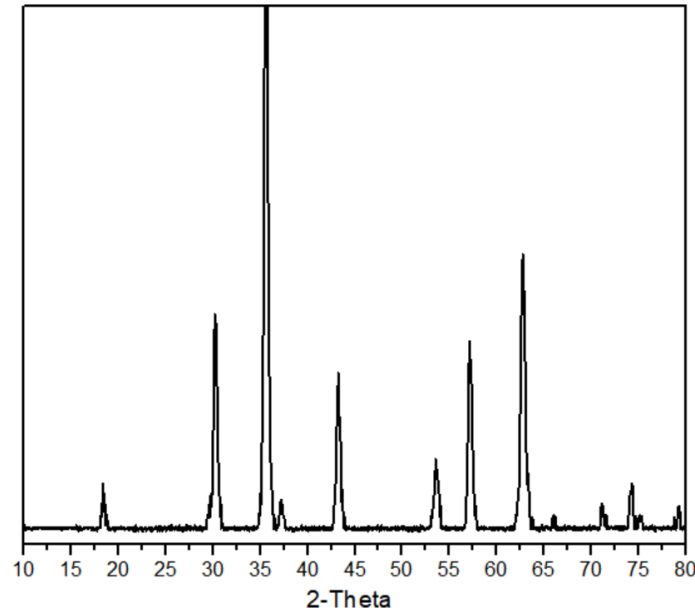
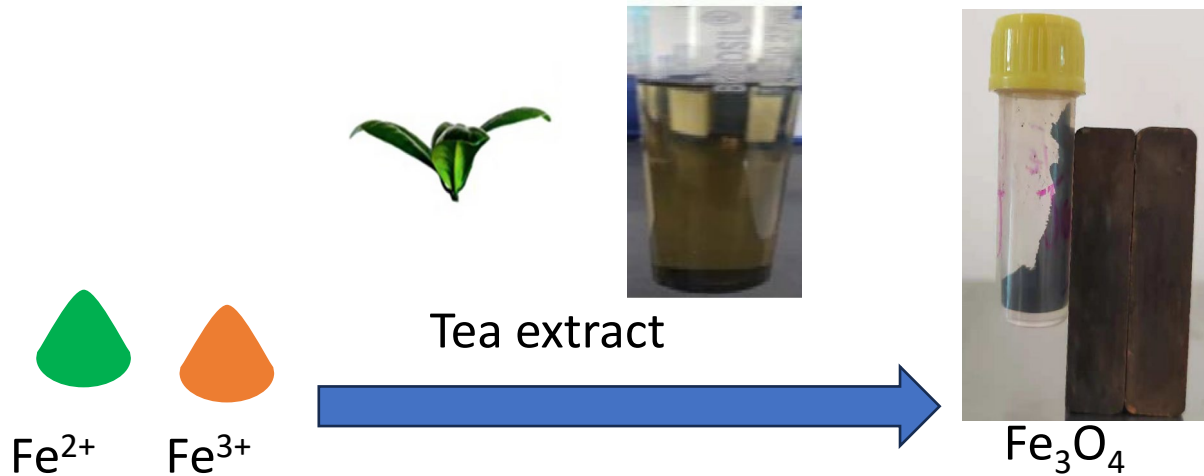


Treatment



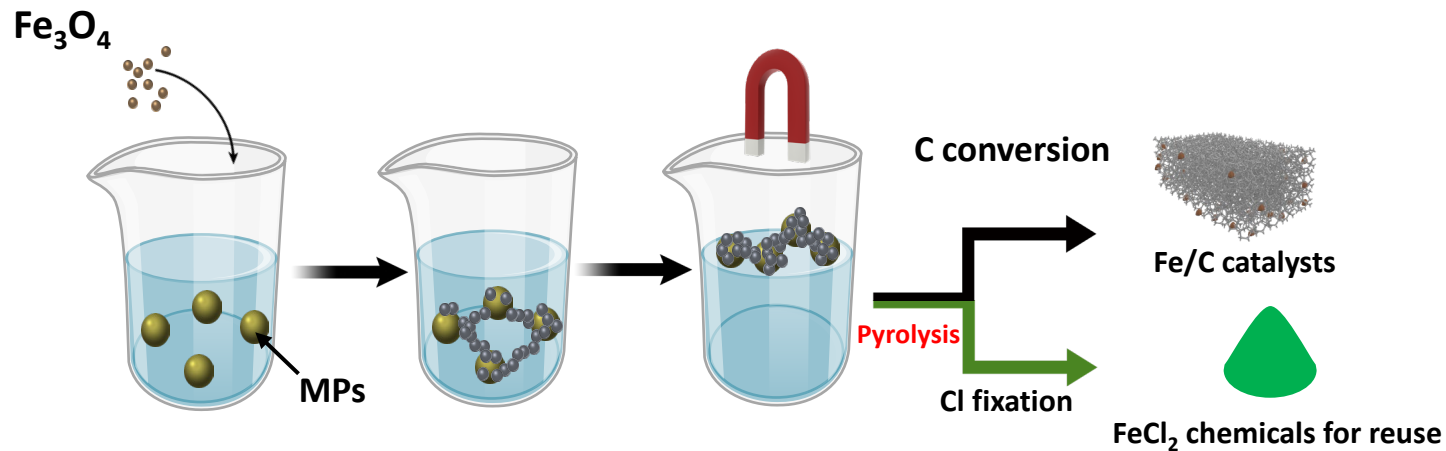
Green synthesized iron oxides for MPs removal & upcycling

Preparation of Fe_3O_4

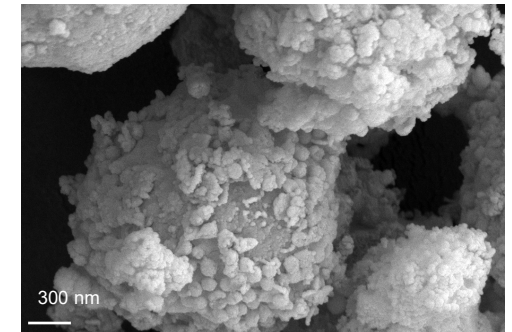
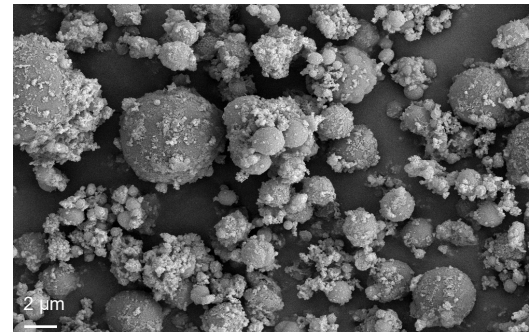
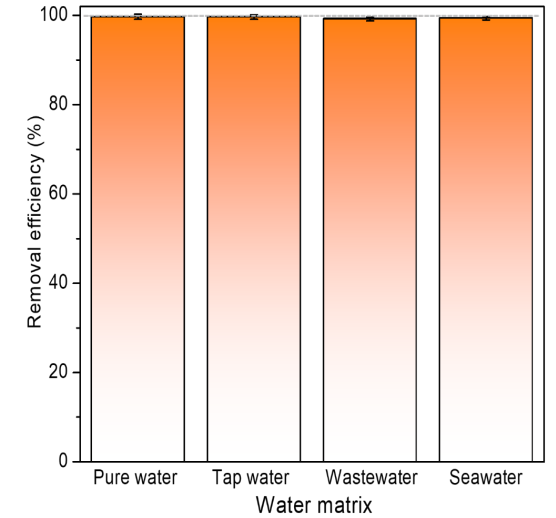
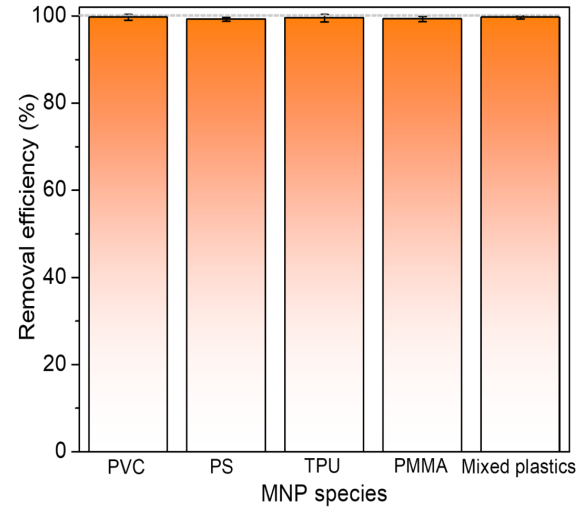
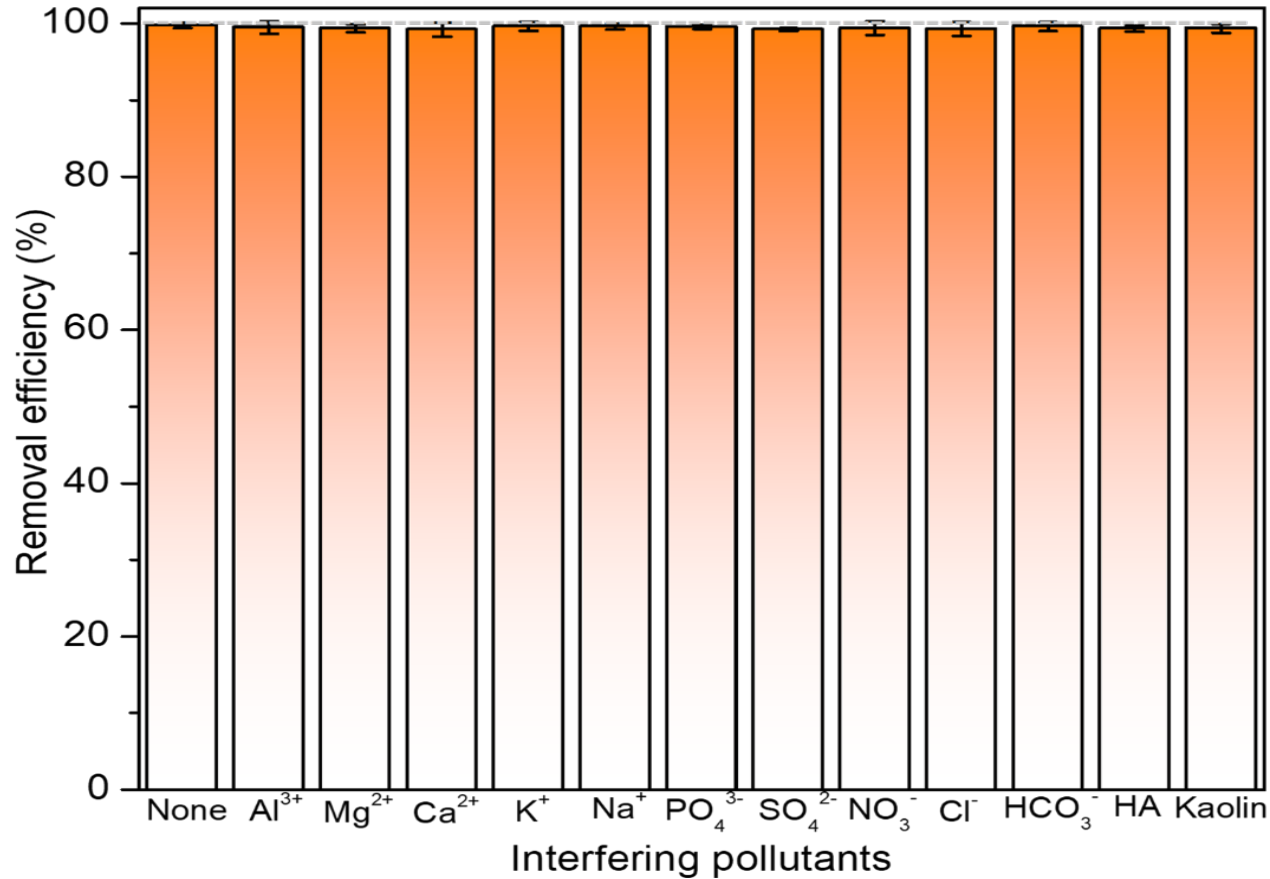


- Nano-sized Fe_3O_4
- High purity

Magnetic removal test

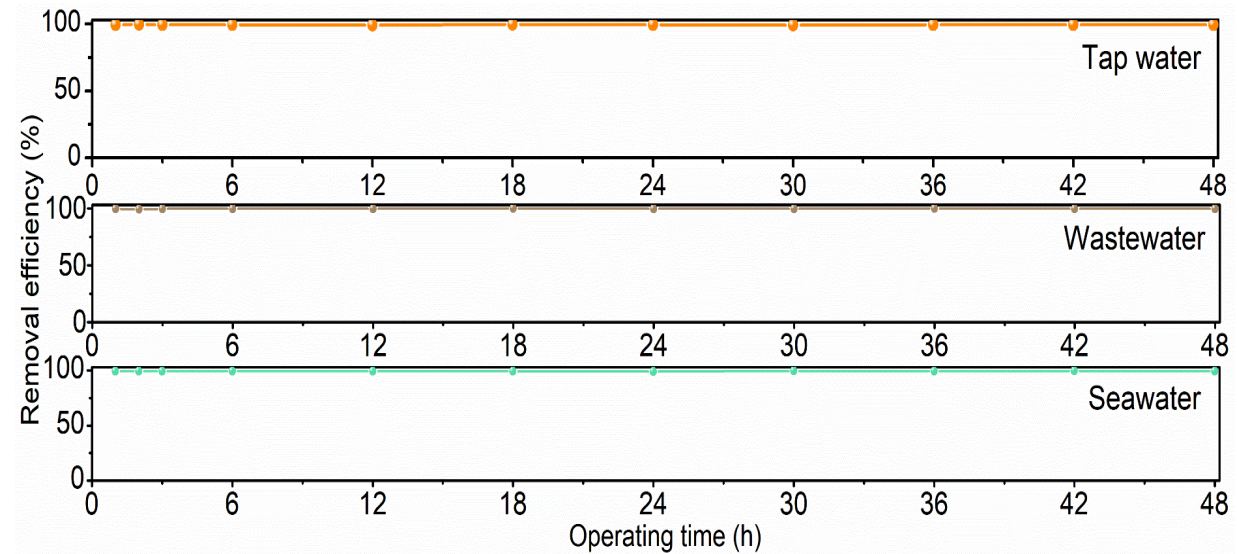


MPs removal performance - Batch tests



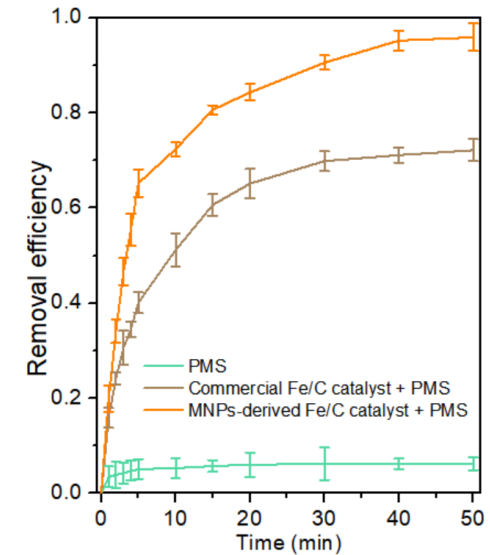
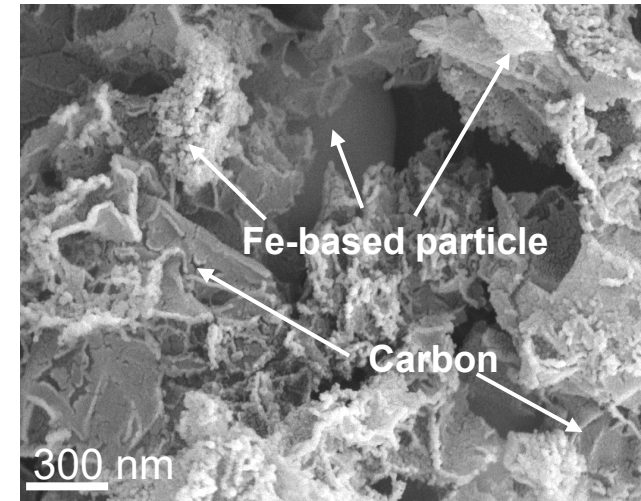
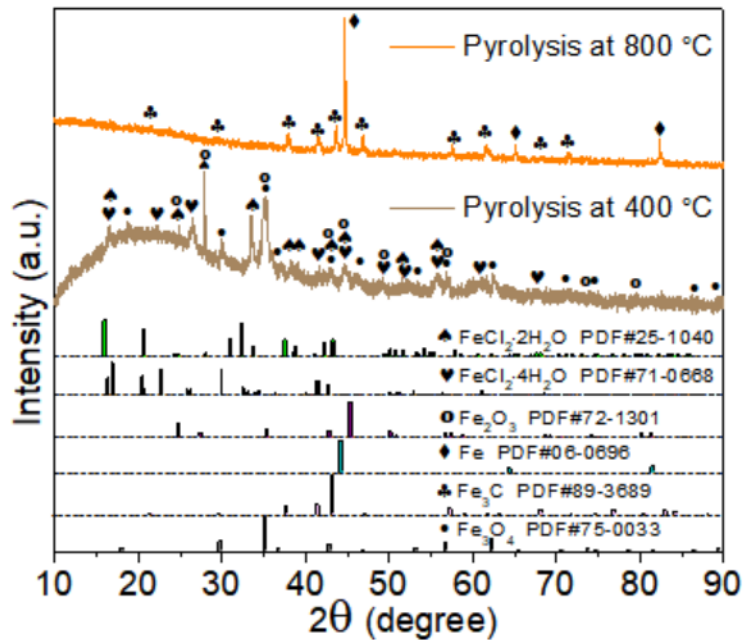
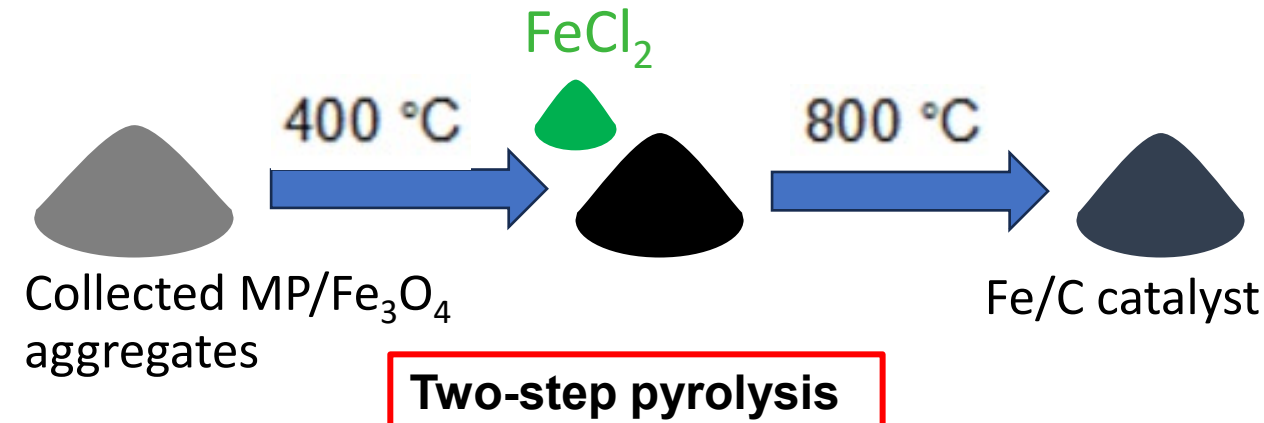
- Organic functional groups on Fe₃O₄ helps to enhance its anti-interference ability
- Fe₃O₄ can remove diverse MPs in different water conditions; optimal consumption: 80 mg/L, pH 5
- Fe₃O₄ firmly adsorbs onto MP surface

Continuous MPs removal system



- 4.5 L/h, MP concentration ranges from 1mg/ml-0.01 mg/ml
- The continuous flow system can removal MPs at a **high efficiency**
- **Good stability**, in various water systems.

Post-management of MP wastes - Upcycling



- **Two-step pyrolysis can help to fix Cl in PVC-containing waste;**
- **Fe₃O₄ acts as a catalyst for Cl fixation;**
- **For mixed plastics, Cl fixation ratio reaches 99%;**
- **The MP waste-derived Fe/C composite catalyst has good catalytic performance for activating PMS towards tetracycline degradation.**

Conclusions

- The **green synthesized Fe_3O_4** has good performance for diverse MPs removal in different water matrices
- The two-step pyrolysis treatment can **fix Cl in PVC-containing waste**, and the **Fe_3O_4 works as a catalyst for Cl fixation**
- The MP waste-derived Fe/C catalyst shows **good catalytic performance for AOP towards pollutant degradation**
- This work offers a practical solution to the **removal, safe management, and valorization of MPs** in water systems.

Thank you!