

Amine/magnetite ($\text{SiO}_2@ \text{NH}_2 \& \text{Fe}_3\text{O}_4$) magnetic Janus Particles

Dual-functional particles for effective removal of multiple contaminants

TECH ID #: 2022-113



Dual-functional surfaces:
Combines amine and magnetite for efficient simultaneous removal of metal ions and organics (e.g., chromium and phenol).



Scalable production: Simple fabrication process allows easy scaling from lab to industry.



Versatile potential: Applicable in water treatment and biomedical fields, including drug delivery and imaging.



Provisional patent filed.

Currently seeking collaboration opportunities: research or licensing.

Background

Amine/magnetite ($\text{SiO}_2@ \text{NH}_2 \& \text{Fe}_3\text{O}_4$) magnetic Janus particles offer an innovative solution for wastewater treatment, developed by researchers at the University of Calgary. These particles feature dual-functional surfaces: amine groups for chromium ion adsorption and magnetite for phenol degradation. They are also directly applicable for removing nickel and vanadium from wastewater without modification. This dual functionality allows for simultaneous removal of multiple contaminants, achieving 81% efficiency for chromium, 100% for phenol, and effectively targeting nickel and vanadium.

The fabrication process of these particles is both simple and scalable, requiring only mild temperatures, ambient pressure, and moderate mixing. This makes large-scale production feasible and cost-effective. Compared to ion exchange membranes or nanofiltration, this technology avoids issues such as fouling, clogging, and channeling, while also reducing capital costs. Future advancements will focus on optimizing the process and exploring nanoscale applications, potentially expanding their use to drug delivery and biomedical imaging.

Competitive Advantages

- **Dual-functional Capability:** Simultaneously targets and removes chromium and phenol contaminants.
- **High Efficiency:** Achieves 81% chromium removal and 100% phenol degradation.
- **Reusability:** Maintains performance over multiple removal and regeneration cycles.
- **Scalable Production:** Simple and cost-effective fabrication process suitable for large-scale applications.

Areas of Application

- **Water Treatment:** Efficiently removes chromium and phenol from wastewater.
- **Biomedical Applications:** DNA/RNA adsorption for biological monitoring.
- **Environmental Remediation:** Targets multiple contaminants in various environmental cleanup processes.
- **Industrial Waste Management:** Enhances the purification of industrial effluents containing complex contaminants.

Publication and Resources

- Journal publication: [A novel synthesis method of magnetic Janus particles for wastewater applications](#)
- Researcher Profile: [Giovannantonio Natale](#)
- Lab website: [Department of Chemical and Petroleum Engineering](#)
- Lab website: [Complex Fluids Lab](#)

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