

Application of Iron Oxide in Water Treatment-A Review

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ABSTRACT

Iron oxide nanomaterials are attractive for removal of harmful metal ions from the water due to their significant features like small size, high surface area to volume ratio and magnetic property. Magnetic property of iron oxide nanomaterials enables easy separation of adsorbents from the system and can be reused for further application. Re-usability of iron oxide nanomaterials reduces economic burden.

Keywords: Iron oxide nanomaterials, Magnetic property of iron oxide.

DISCUSSION AND PERSPECTIVES

Availability of clean water for the growing population is one of the major challenges world faces. Toxic metal ions are among the most common pollutants that pollute the aqueous environment and harm health of humans, animals and plants¹. There are different techniques to remove these toxic metal ions, such as chemical precipitation², solvent extraction³, ion exchange⁴, reverse osmosis⁵, and nanofiltration⁶. Among these techniques, adsorption is measured efficient and cost-effective due to its high efficiency, low-cost, easy handling, and also the availability of different adsorbents⁷. Nanomaterials reveal high-quality result than other techniques used in water treatment due to of their high surface area to volume ratio⁸. In addition to having high surface areas to volume ratio, nanoparticles also have unique adsorption properties due to distributions of active surface sites⁹. Magnetic property is a unique physical property that independently helps in water purification by influencing the physical properties of contaminants in water¹⁰. Magnetic nanomaterials have been explored broadly in water treatment application. Many researchers have proved that magnetic nanomaterials particularly magnetite (Fe_3O_4) and maghemite ($\gamma\text{-Fe}_2\text{O}_3$) are extensively used in removal of heavy metal ions from water^{11,12}. It was observed that the maximum adsorption capacity for Pb (II) ions was 36.0 mg g⁻¹ by magnetite nanomaterials¹³. The small size of magnetite

nanoparticles was favorable for the diffusion of metal ions from solution onto the active sites of the surface of the magnetite nanomaterial. It suggested that magnetite nanomaterials were effective and economical adsorbents for rapid removal and recovery of metal ions from wastewater¹⁴.

CONCLUSION

Magnetism has an essential role in water treatment. Iron oxide nanomaterials are best nano-adsorbents because of their high surface area to volume ration and magnetic property. Economic burden is reduced due to their reusability.

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