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APPLICATION OF MAGNETIC NANOPARTICLES IN DRINKING WATER PURIFICATION

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Abstract

Pathogenic bacteria are fetal to human health, requiring cost-effective and safe approaches to be removed from drinking water source. With poly-allylamine-hydrochloride (PAAH) stabilization, magnetic nanoparticles (MNPs) were introduced in this study to remove pathogenic bacteria by electrostatic interaction and magnet capture. High removal efficiency was achieved for four main pathogenic species, as *Escherichia*, *Acinetobacter*, *Pseudomonas* and *Bacillus*, and over 99.5% of the pathogens can be removed when the bacterial count was less than 10^5 CFU/mL. Related to various species, the MNPs have respective adhesion effects on bacterial cells, which are higher for *Acinetobacter* and *Pseudomonas*, due to the mechanisms of external cell structure and ion exchange capacity, but not the zeta potential of bacterial cell surface. With the practical application in real drinking water samples collected from reservoirs in Sheffield and Leeds, the results showed high bacteria removal efficiency (99.48%) and the total bacteria residual counts was as low as 78 CFU/mL, which met the drinking water standard of WHO (<100 CFU/mL). Further toxicity test indicated that no significant genotoxicity or cytoxicity existed in MNPs treated water, suggesting MNPs are biocompatible for safety issues in drinking water. As an effective, easy-operation and low cost technique, MNPs have bright future and great potential in practical drinking water treatment to remove pathogenic bacteria.

Key words: drinking water, magnetic nanoparticles (MNPs), pathogenic bacteria, water purification

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