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Dispersion and Aggregation of Magnetic Nanoparticles for Nuclear Waste Separation[1] H. HAN, M. KAUR T. SINGH, Y. QIANG, Physics Department, University of Idaho, Moscow ID 83843, A. JOHNSON, A. PASZCZYNSKI, Environmental Biotechnology Institute, University of Idaho, Moscow ID 83843
— A novel method of nuclear waste separation using conjugates of actinide chelators and magnetic nanoparticles (MNPs) is developed. The fast separation can be facilitated by the high magnetic moments of core-shell MNPs. Highly uniform dispersion of MNPs in solutions is required for the efficient conjugation. However, stabilization of well dispersed MNPs hinders fast magnetic collection of the conjugates. To address this dilemma, the dispersion and aggregation of the MNPs has been investigated in both mechanical and chemical approaches. In the mechanical approach, continuous ultrasonic dispersed the MNPs, whereas they re-aggregated after up to 20 minutes treatment. Bead beating method improved the MNPs' suspension time by up to two factors. Nevertheless, the magnetization of MNPs dropped sharply due to the generation of non-magnetic beads' residual. Chemical method using electrolyte and agents with different polarizations had significant effects on the suspension and aggregation of the various sized MNPs. The fine balance of Van de Waals, Brownian forces, magnetic dipole and Coulomb interactions are discussed.

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