

Applications of magnetite nanoparticles for water treatment and for DNA and cell separation

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Abstract: Magnetic nanoparticles with a diameter of 15 nm prepared by using the coprecipitation method have been applied to enforce the sedimentation of the solid waste, to adsorb the arsenic ions in water, to increase the DNA concentration by using a magnetic field for the electrochemical DNA sensor and to separate the helper CD4⁺ T cells to determine the number of the cells in blood. A combination of magnetic nanoparticles and alum makes the solid waste in water under a magnetic field aggregate a dozen times faster than under the gravity alone. A concentration of 0.1 mg/l of arsenic in water was reduced to a value lower than the permissible concentration of 0.01 mg/l after few minutes of stirring. The particles functionalized with 3-aminopropyl triethoxysilane were used to enrich the DNA of the Herpes virus, which extended the sensitivity of an electrochemical sensor down to a concentration lower than nM/l. The particles coated with fluorescent-labeled antiCD4 antibody were used to count the helper CD4⁺ T cells. The fluorescence signals of the particle/cell system were two times stronger than those of the fluorescence antiCD4 cell system. This can be used for the treatment of an HIV-infected patient with a simple fluorescent microscope.

Author Keywords: Arsenic removal; CD4⁺ T cell; Cell separation; DNA separation; Magnetic nanoparticles

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