Ultrasensitive fluorometric determination of hydrogen peroxide and glucose by using multiferroic BiFeO3 nanoparticles as a catalyst

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Abstract: BiFeO3 magnetic nanoparticles (BFO MNPs) are used as a catalyst to develop an ultrasensitive method for the determination of H2O2. It is found that BFO MNPs can catalyze the decomposition of H2O2 to produce {radical dot}OH radicals, which in turn oxidize the weakly fluorescent benzoic acid to a strongly fluorescent hydroxylated product with a maximum emission at 405 nm. This makes it possible to sensitively quantify traces of H2O2. Under optimized conditions, the fluorescence intensity is observed to be well linearly correlated with H2O2 concentration from 2.0 × 10-8 to 2.0 × 10-5 mol L-1 with a detection limit of 4.5 × 10-9 mol L-1 (S/N = 3). In addition, a selective method for glucose determination is developed by using both glucose oxidase and BFO MNPs, which has a linear range for glucose concentration from 1.0 × 10-6 to 1.0 × 10-4 mol L-1 with a detection limit of 5.0 × 10-7 mol L-1. These new methods have been successfully applied for the determination of H2O2 in rainwater and glucose in human serum samples.

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