

Colorimetric detection of antibiotic residues using functionalized magnetic nanoparticles and platinum nanoparticles

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Here we describe the development of a rapid and facile method for the colorimetric detection of penicillin antibiotics, including penicillin G, penicillin V, nafcillin, oxacillin, cloxacillin and dicloxacillin, using hybrid magnetic nanoparticle clusters (HMNCs) and penicillin class-selective, antibody-functionalized platinum nanoparticles (Ab-Pt). Amine-functionalized HMNCs were used to chemically capture antibiotics from sample solution through the formation of amide bonds between amine groups of HMNCs and carboxyl groups of the antibiotics. Ab-Pt was then allowed to bind to antibiotic-HMNC complexes, after which the resulting Pt-antibiotic-HMNCs were added to a 3,3',5,5'-tetramethylbenzidine (TMB) solution. The color change caused by platinum nanoparticle-mediated oxidation of TMB enabled antibiotics to be identified with the naked eye and quantified by measuring light absorption. The use of the penicillin class-selective antibody allowed the simultaneous detection of penicillin class antibiotics, thereby reducing the cost, time, and effort associated with prescreening antibiotic residues in sample specimens.