biosensors

MDPI

Supplementary Material

Fe_3O_4@Au Core–Shell Magnetic Nanoparticles for the Rapid Analysis of *E. coli* O157:H7 in an Electrochemical Immunoassay

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Nanomaterials synthesis and functionalization details

The Fe_3O_4 MNPs were synthesized by the thermal decomposition method according to the procedure reported in reference [1]. Briefly, NMP (35 mL), oleic acid (0.3 M), 1-hexadecanol (0.3 M), and oleylamine (0.3 M) were mixed and heated to 200 °C (under stirring and inert atmosphere). Then, $[Fe(acac)_3]$ (0.15 M, 10 mL) was quickly added to the previously heated solution, and the stirring was continued for 1 h. Afterward, the reaction mixture was cooled and kept under stirring overnight. The resulting nanoparticles were precipitated by adding ethanol (50 mL), and the material was washed several times with ethanol (to remove the excess of oleylamine and oleic acid) and redispersed in anhydrous toluene (5 mL).

The Fe_3O_4@Au core–shell NPs were prepared using a Fe_3O_4:$HAuCl_3$ molar ratio of 1:7. Briefly, the Fe_3O_4 dispersion (1.25 mL) was diluted with anhydrous toluene (20 mL), and heated to 100 ºC, under an inert atmosphere. Subsequently, a solution containing $HAuCl_4.3H_2O$, oleylamine (7.07 mL), and anhydrous toluene (35 mL) was added (dropwise under vigorous stirring) to the pre-heated dispersion. The reaction mixture was stirred for 1 h. Then, the system was cooled to room temperature, and absolute ethanol (50 mL) was added. The coated nanoparticles were magnetically separated and washed several times with ethanol. The final nanomaterial was redispersed in anhydrous toluene (10 mL) and a dark red-purple dispersion was obtained.

The Fe_3O_4@Au concentration was determined as the amount of nanoparticles per mL (mg/mL). The functionalization of the core–shell MNPs (4 mg/mL) was performed with a solution containing 6-mercapto-1-hexanol (MCH) 0.1 M and thioctic acid (TOA) 0.1 M in ethanol. The ethanolic thiol mixture with a volume ratio of 3:1 was added to the Fe_3O_4@Au dispersion and kept under stirring overnight. Then, the supernatant was removed by an external magnet, and the NPs were dispersed in a buffer solution (B1).

References

1. Freitas, M.; Sá Couto, M.; Barroso, M.F.; Pereira, C.; De-Los-Santos-Álvarez, N.; Miranda-Ordieres, A.J.; Lobo-Castañón, M.J.; Delerue-Matos, C. Highly Monodisperse Fe3O4@Au Superparamagnetic Nanoparticles as Reproducible Platform for Genosensing Genetically Modified Organisms. *ACS Sens* **2016**, *1*, 1044–1053, doi:10.1021/acssensors.6b00182.