Electronic Supplementary Information

In Situ Formation of Chiral Core-Shell Nanostructures with Raspberry-Like Gold Core and Dense Organic Shells using Catechin and Their Catalytic Application

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Figure S1: Photographs showing color changes at different stages during the synthesis of core-shell nanostructures.
Figure S2. Zeta potential of different samples (A) Cat\textsubscript{1}Au\textsubscript{1} (B) Cat\textsubscript{2}Au\textsubscript{1} (C) Cat\textsubscript{3}Au\textsubscript{1} as measured from their aqueous suspensions.
Figure S3. UV-vis absorption spectra of the aqueous suspension of the sample Cat_{1}Au_{1} for one, seven and ten days.
Figure S4. Powder X-ray diffraction patterns of different core-shell samples (see Table 1).
Figure S5: Histogram of particle size distribution of different samples (A) Cat$_1$Au$_1$ (B) Cat$_2$Au$_1$ and (C) Cat$_3$Au$_1$. 
[A] = 327.073
g = 1.99656

Figure S6. Electron paramagnetic resonance (EPR) spectrum of the sample Cat1Au1 at 77 K.
Figure S7. TGA thermograms of the sample Cat$_1$Au$_1$ and neat catechin. TGA thermograms reveals about 18 wt % organic materials is present as a shell in the core-shell nanostructures.
**Figure S8.** TEM images of (A) GNPs synthesized at pH = 9 and (B) GNPs synthesized in presence of MUA using catechin as a reducing agent.
Figure S9. $^1$H NMR spectrum of the isolated and purified shell materials obtained after KCN treatment followed by the dissolution in d$_6$-DMSO.
Figure S10. TEM image of the sample Cat_{1}Au_{1} sample after ligand exchange with MUA for 24h.
Figure S11. Plot showing dissolution of gold of Cat$_{1}$Au$_{1}$ core-shell sample and citrate-stabilized Au nanoparticle sample with KCN in water at 25 °C.
**Figure S12.** Schematic representation for the dissolution of Au core of the core-shell nanostructures and the formation of nanospheres by the assembly of oxidized products of catechin obtained after KCN treatment as shown in Scheme 1.
Figure S13. Plot showing log-normal distributions of the sizes of the sample Cat$_1$Au$_1$ and the nanospheres obtained from the solution of sample Cat$_1$Au$_1$ after with KCN.
Figure S14. Successive UV-vis absorption spectra with time of the borohydride reduction of $p$-nitrophenol using different core-shell nanostructured samples.
**Figure S15.** Plot showing $\ln A$ ($A$ = normalized absorbance at 400nm of $p$-nitrophenolate ion) versus time (s) in the reduction of $p$-nitrophenol catalyzed by $[C_2\text{mim}][A]$-Au raspberry shaped gold nanoparticles without any coating.