Electronic Supplementary Material (ESI) for RSC Advances.

Electronic Supplementary Information

Facile Synthesis of Au@Ag-Hemin Decorated Reduced Graphene Oxide Sheets: A Novel Peroxidase Mimetic for Ultrasensitive Colorimetric Detection of Hydrogen Peroxide and Glucose

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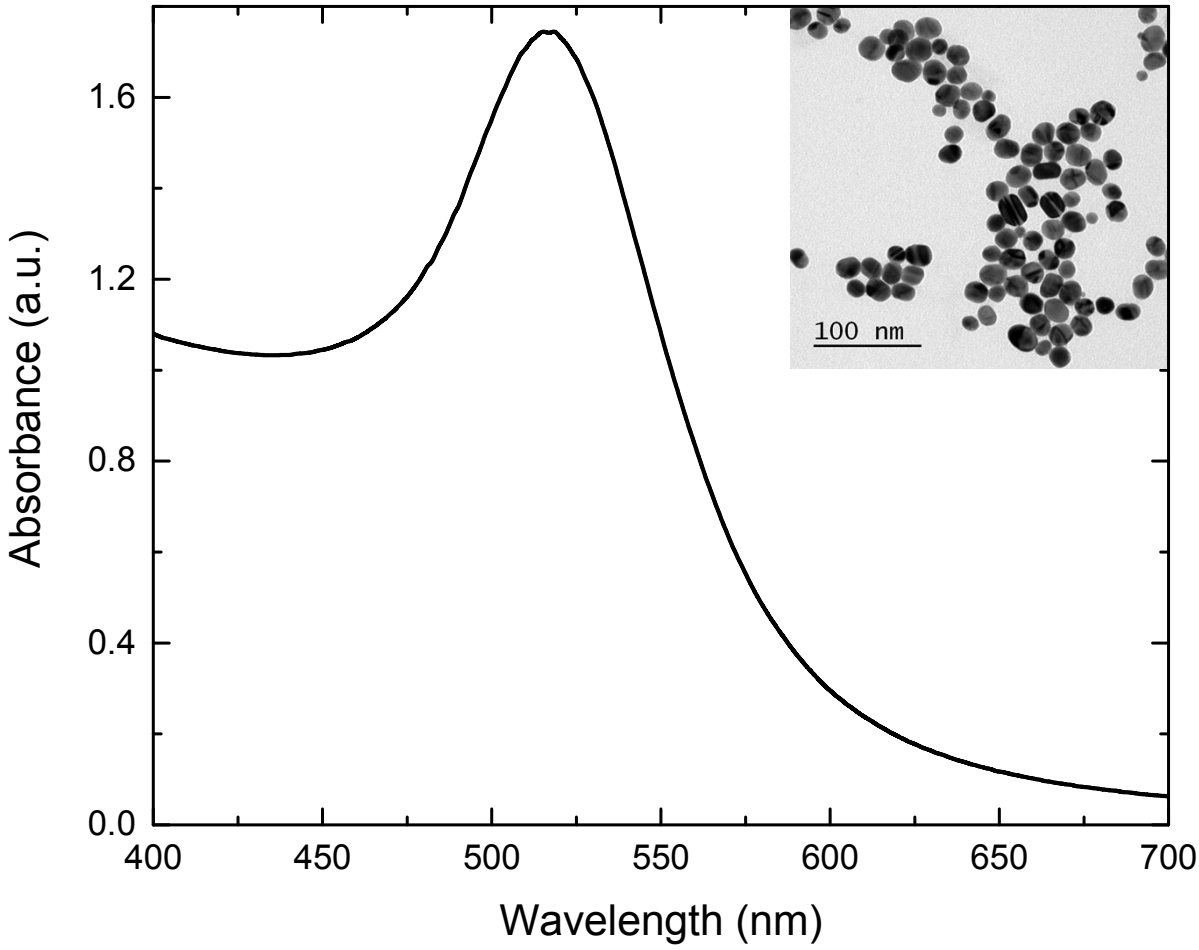

Figure S1. UV-vis spectrum of Au seed solution prepared as a precursor for AuNS with the respective TEM image (inset).

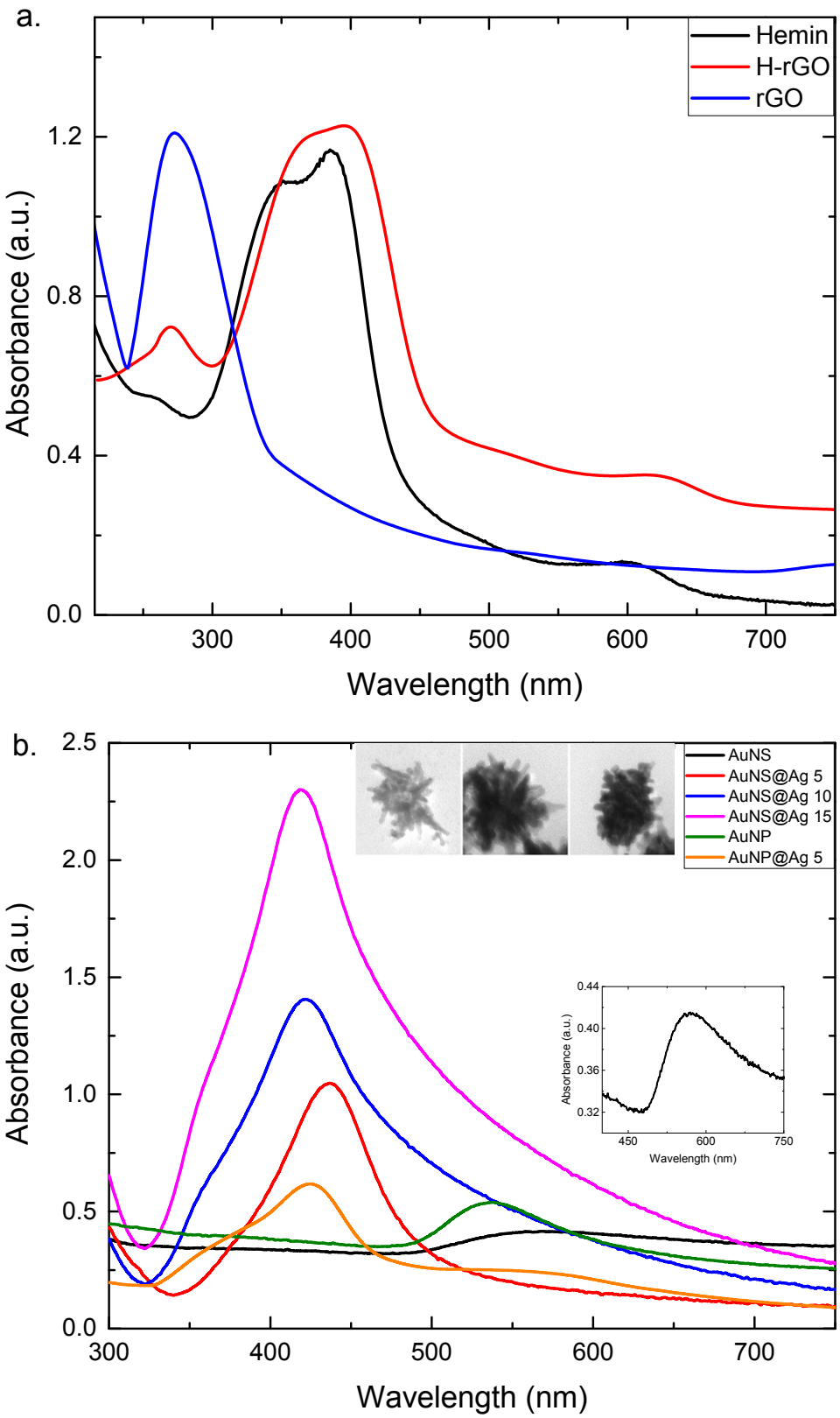

Figure S2. UV-vis absorption spectra of the as-synthesized nanocomposites (a) rGO, hemin and hemin-rGO and (b) AuNS, AuNP, silver coated AuNP and AuNSs coated with varying amounts of silver nitrate (5, 10 and 15 mL). Inset shows the absorption maximum of AuNS at 582 nm. TEM images of AuNS@Ag-5, AuNS@Ag-10 and AuNS@Ag-15 (left to right) are also shown as an inset.

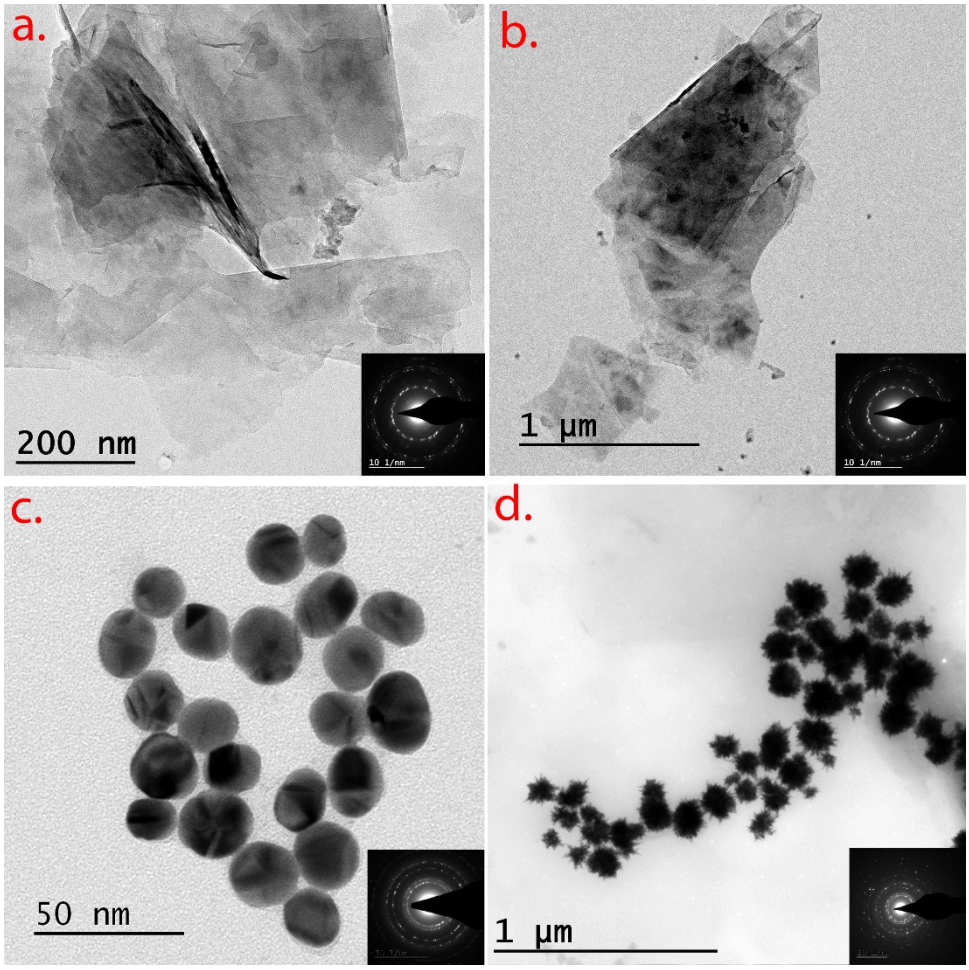

Figure S3. TEM images of (a) rGO, (b) H-rGO, (c) AuNPs and (d) AuNS. Lower insets are the respective SAED patterns.

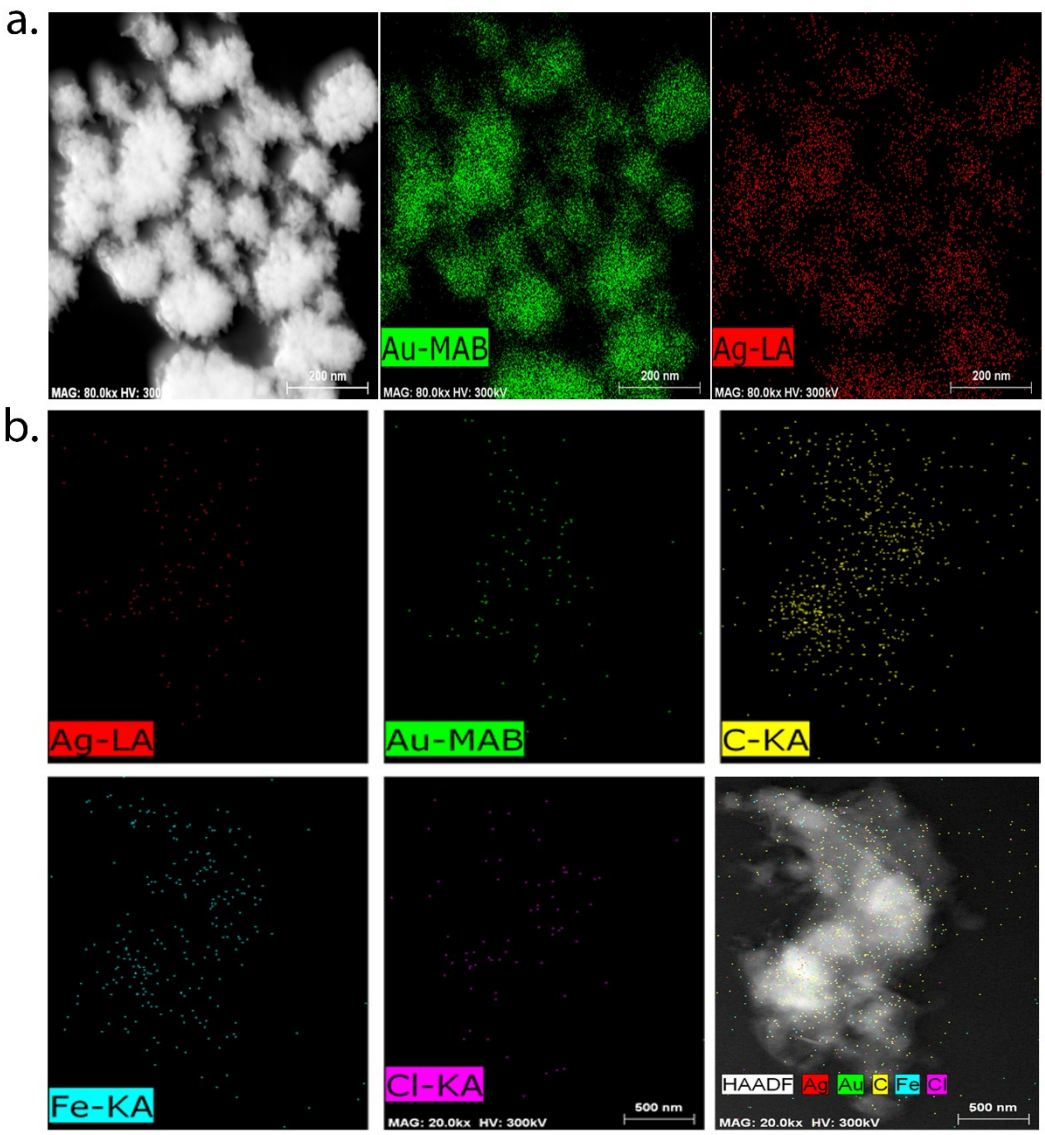

Figure S4. Dark field STEM images and elemental mapping of the (a) AuNS@Ag and (b) AuNS@Ag-H-rGO.

Element	Weight%	Atomic%
C K	36.00	47.88
O K	50.16	50.08
Cl K	0.64	0.29
Fe K	0.61	0.17
Ag L	8.25	1.22
Au M	4.34	0.35
Totals	100.00	

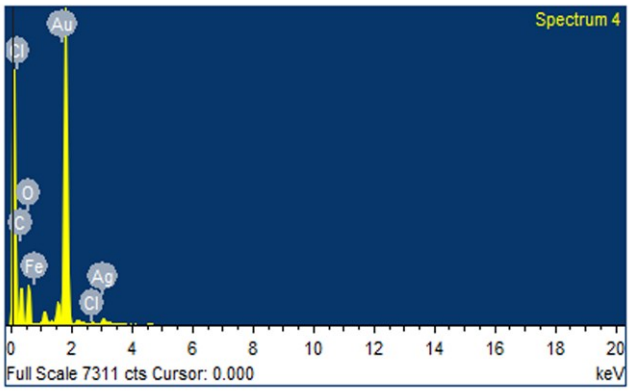

Figure S5. EDS of the AuNS@Ag-H-rGO nanocomposite.

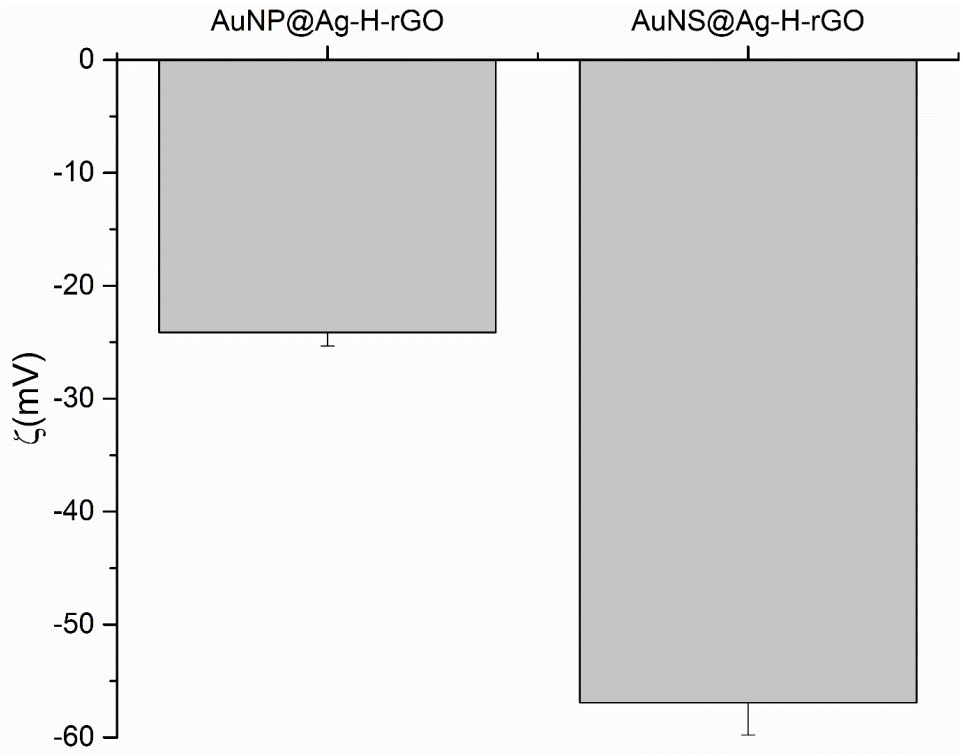

Figure S6. Zeta potential of the as-synthesized nanocomposites: AuNP@Ag-H-rGO and AuNS@Ag-H-rGO.

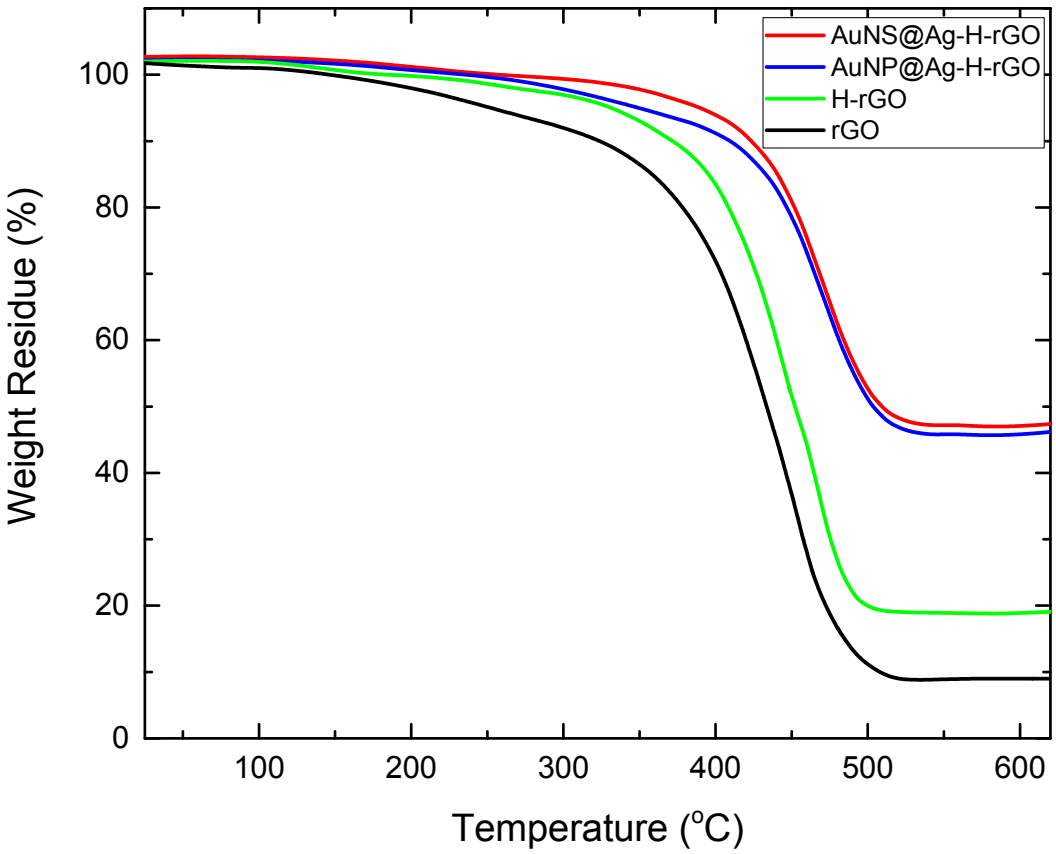

Figure S7. TGA curves of as-synthesized rGO, H-rGO, AuNP@Ag-H-rGO and AuNS@Ag-H-rGO nanocomposites in O_2 atmosphere.

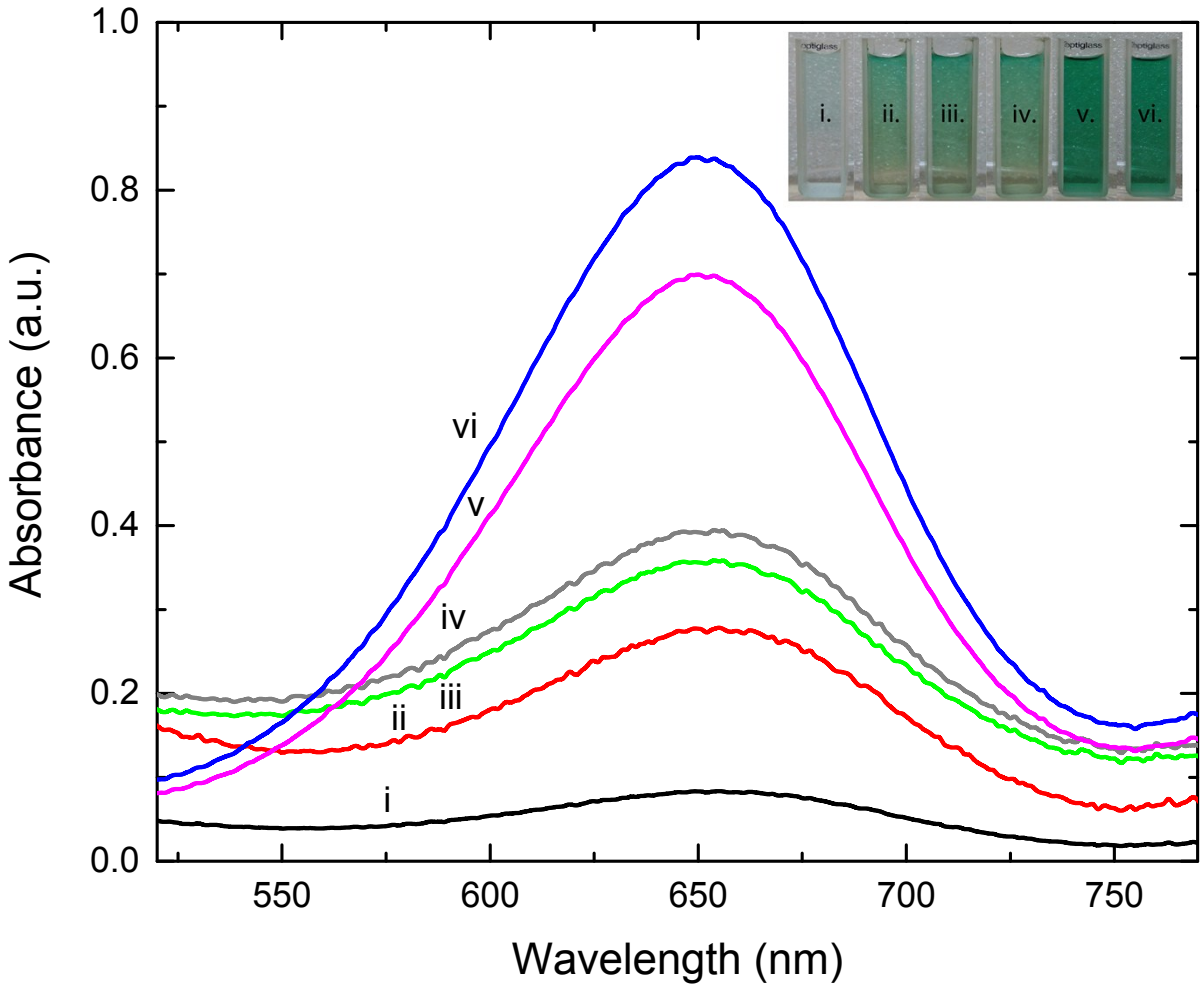

Figure S8. UV-Vis spectra of a mixture of TMB and H_2O_2 in the presence of (i) no nanocomposite, (ii) H-rGO, (iii) AuNP@Ag, (iv) AuNS@Ag, (v) AuNP@Ag-H-rGO and (vi) AuNS@Ag-H-rGO. Inset is the photograph of the above solutions after 5 min.

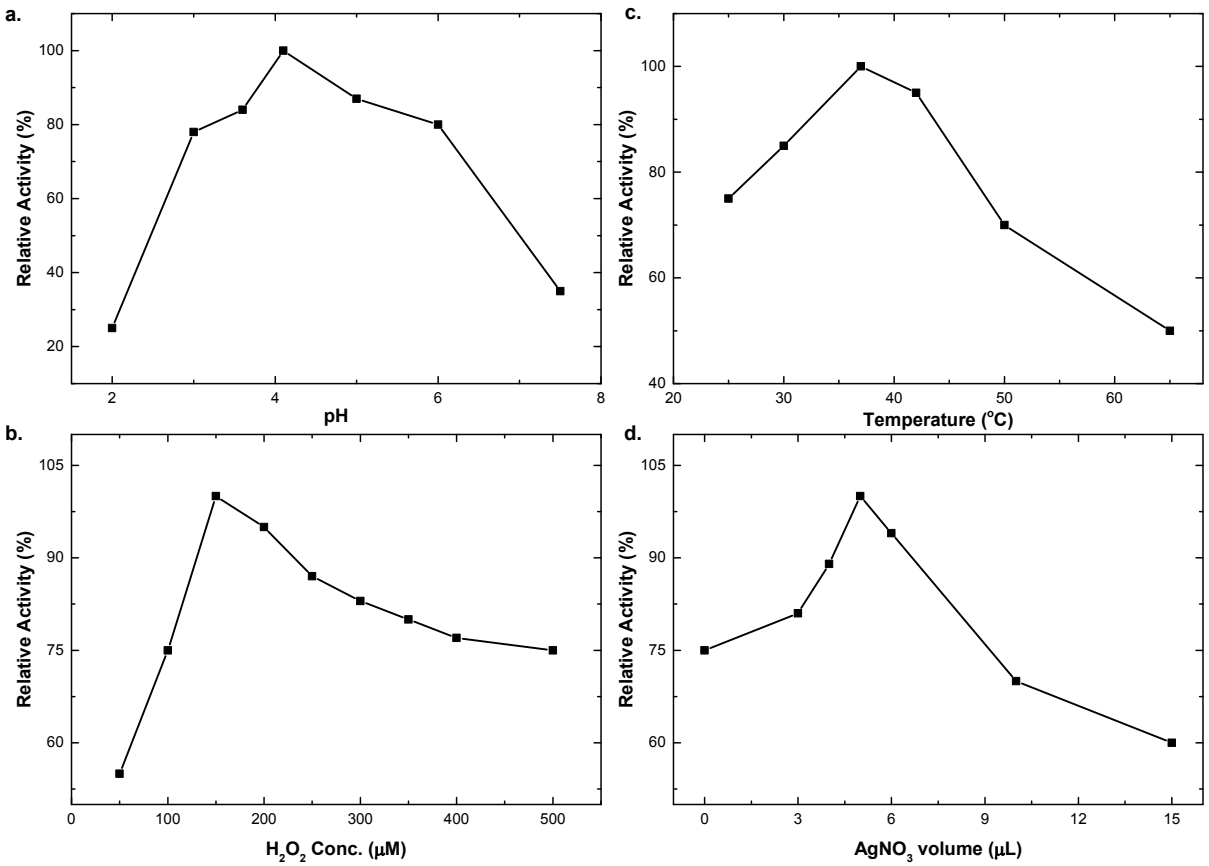

Figure S9. Optimal reaction conditions of AuNP/AuNS@Ag-H-rGO. Effect of (a) pH, (b) temperature and (c) H_2O_2 concentration on the catalytic oxidation of TMB and (d) Relative activity plot of AuNSs with varying amounts of coated silver. The highest point was defined as 100% relative activity for each curve.

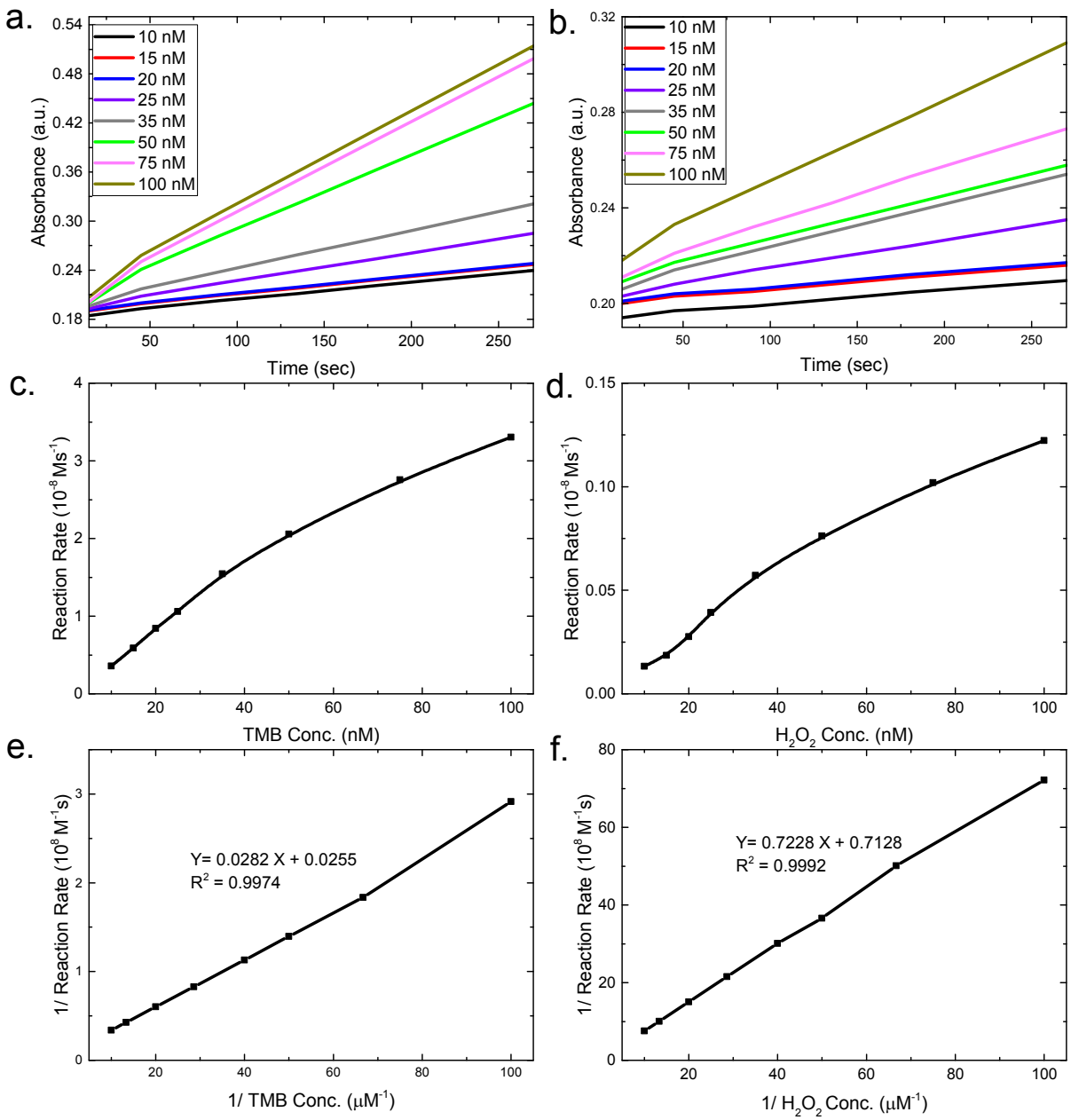

Figure S10. Time-dependent UV-vis absorption spectra for AuNP@Ag-H-rGO at various concentrations of (a) TMB and (b) H_2O_2 at 652 nm. Michaelis-Menten plot for (c) TMB and (d) H_2O_2. Double reciprocal plots of activity of AuNP@Ag-H-rGO in the presence of different concentrations of (e) TMB and (f) H_2O_2.

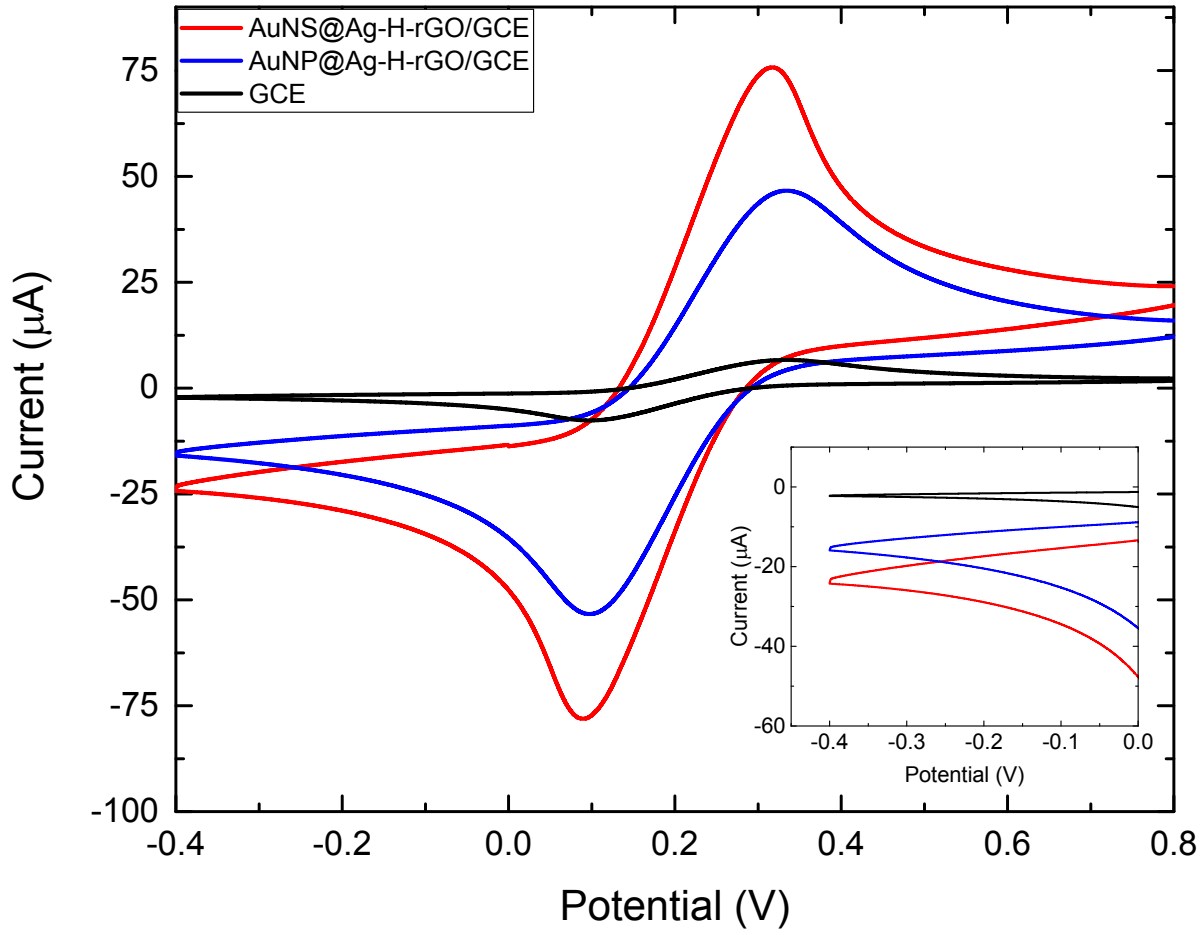

Figure S11. Cyclic voltammograms of bare GCE, AuNP@Ag-H-rGO modified GCE and AuNS@Ag-H-rGO modified GCE in 0.1 M PBS (pH 7.4) in the presence of 1.0 mM H_2O_2. Scan rate: 50 mVs^{-1}.

Table S 1. Limit of detection with H_2O_2 as the analyte using different catalysts.

Peroxidase Mimetic	Linear Range	LOD	Remarks
Au-H-rGO nanocomposite[1]	0.05–40 µM	5 nM	
CuZnFeS nanocrystals[2]	10 to 55 µM	3 µM	
Yolk–shell nanostructured Fe3O4@C nanoparticles[3]	1–20 µM	0.39 µM	
Graphene oxide–Fe3O4 magnetic nanocomposites[4]	1–50 µM	0.32 µM	
AuNP@Ag-5-H-rGO	10-35 nM	3.09 nM	In this study
AuNS@Ag-5-H-rGO	10-35 nM	1.26 nM	In this study

References:

1. X. Lv and J. Weng, *Sci. Rep.*, 2013, **3**, 3285.
2. A. Dalui, B. Pradhan, U. Thupakula, A. H. Khan, G. S. Kumar, T. Ghosh, B. Satpati and S. Acharya, *Nanoscale*, 2015, **7**, 9062-9074.
3. N. Lu, M. Zhang, L. Ding, J. Zheng, C. Zeng, Y. Wen, G. Liu, A. Aldalbahi, J. Shi and S. Song, *Nanoscale*, 2017, **9**, 4508-4515.
4. Y.-l. Dong, H.-g. Zhang, Z. U. Rahman, L. Su, X.-j. Chen, J. Hu and X.-g. Chen, *Nanoscale*, 2012, **4**, 3969-3976.