Electronic Supplementary Information (ESI)

One Pot Green Synthesis of Polyaniline Coated Gold Nanorods and its Applications

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Table 1: Different nanostructures with different aniline concentration

Composite name	Aniline [mmol]	Citric acid (CA) [mmol]	$HAuCl_4$ [mmol]	[CA]: [$HAuCl_4$]	[CA]: [aniline]	[$HAuCl_4$] :[aniline]	Observed Morphology	Aspect Ratio	Thickness of PANI layer (nm)	Reduction Rate (Sec^{-1})
Au/PANI@$_{0.0}$	0.0931 g (1.0)	----	0.0039 g (1.0)	----	----	1:1	Spherical	1.09	~30	0.00254
Au/PANI@$_{2.0}$	0.186 g (2.0)	0.0019 g (1.0)	0.0039 g (1.0)	1:1	1:2	1:2	Dumbbell shaped with tiny particles	2.90	~5.0	0.01025
Au/PANI@$_{1.0}$	0.0931 g (1.0)	0.0019 g (1.0)	0.0039 g (1.0)	1:1	1:1	1:1	Fibrous	30.88	~5.0	0.00988
Au/PANI@$_{0.2}$	0.0186 g (0.2)	0.0019 g (1.0)	0.0039 g (1.0)	1:1	1:0.2	1:0.2	Fibrous with tiny particles	24.30	~17	0.00588
Au/PANI@$_{0.1}$	0.0093 g (0.1)	0.0019 g (1.0)	0.0039 g (1.0)	1:1	1:0.1	1:0.1	Large and tiny particles	1.09	~18	0.00508

TableS1 Preparation of Au/PANI nanostructures at room temperature (25 ^oC).

TEM image and UV-Vis of synthesized Au-60 seed solution

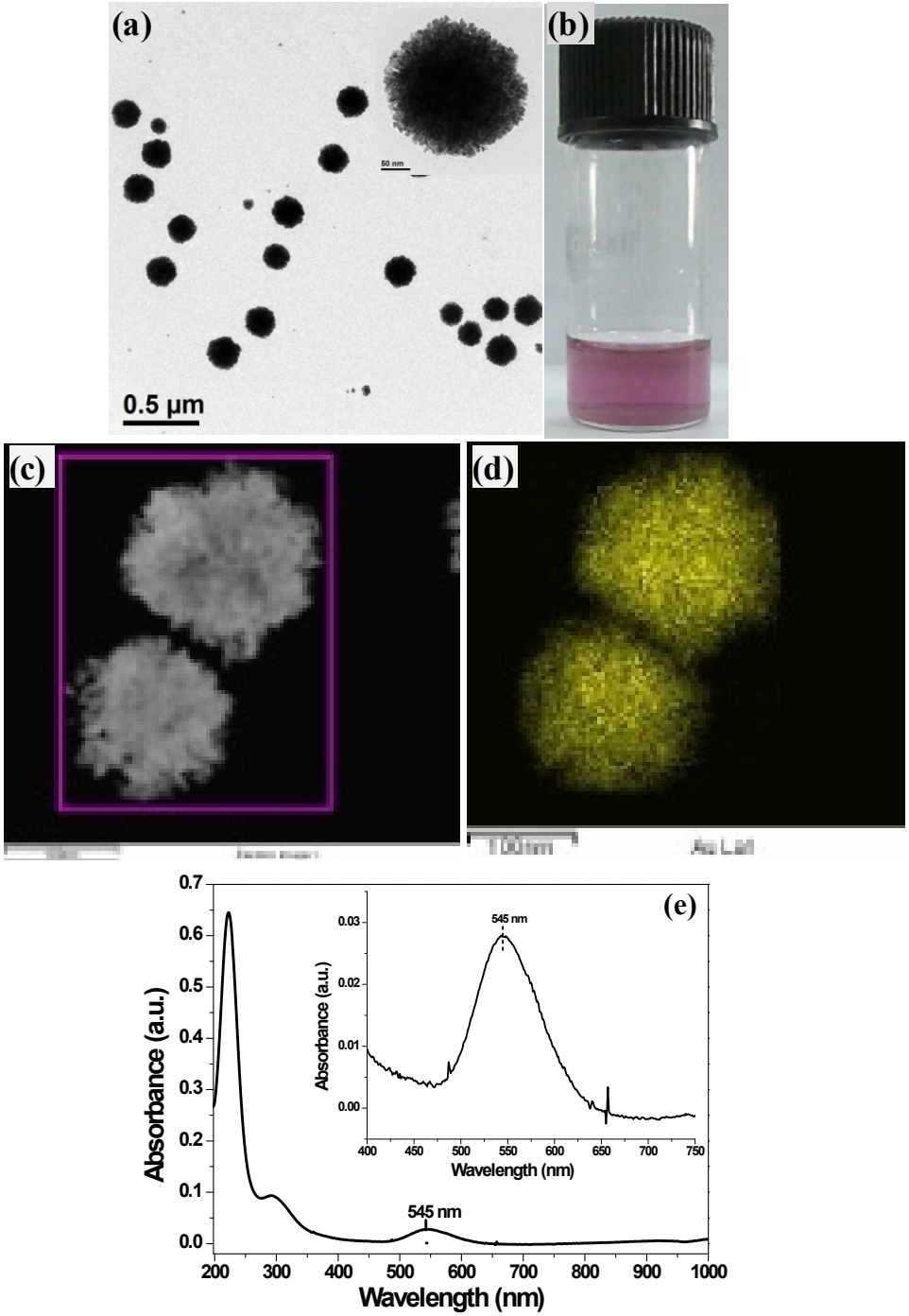

Fig.S1 (a) Bright field TEM image of CA stabilized gold seed (Au-60) solution recorded after 1 hr of reaction, (b) Corresponding digital picture, (c) Dark field image of same solution, (d) Corresponding mapping image, (e) UV-Vis spectra of CA stabilized gold seed (Au-60) recorded after 1 hr synthesized at room temperature (25 ^{o}C) CA to $HAuCl_4$ molar ratio was 1:1.

TEM image and UV-Vis spectra of synthesized Au-240 seed solution

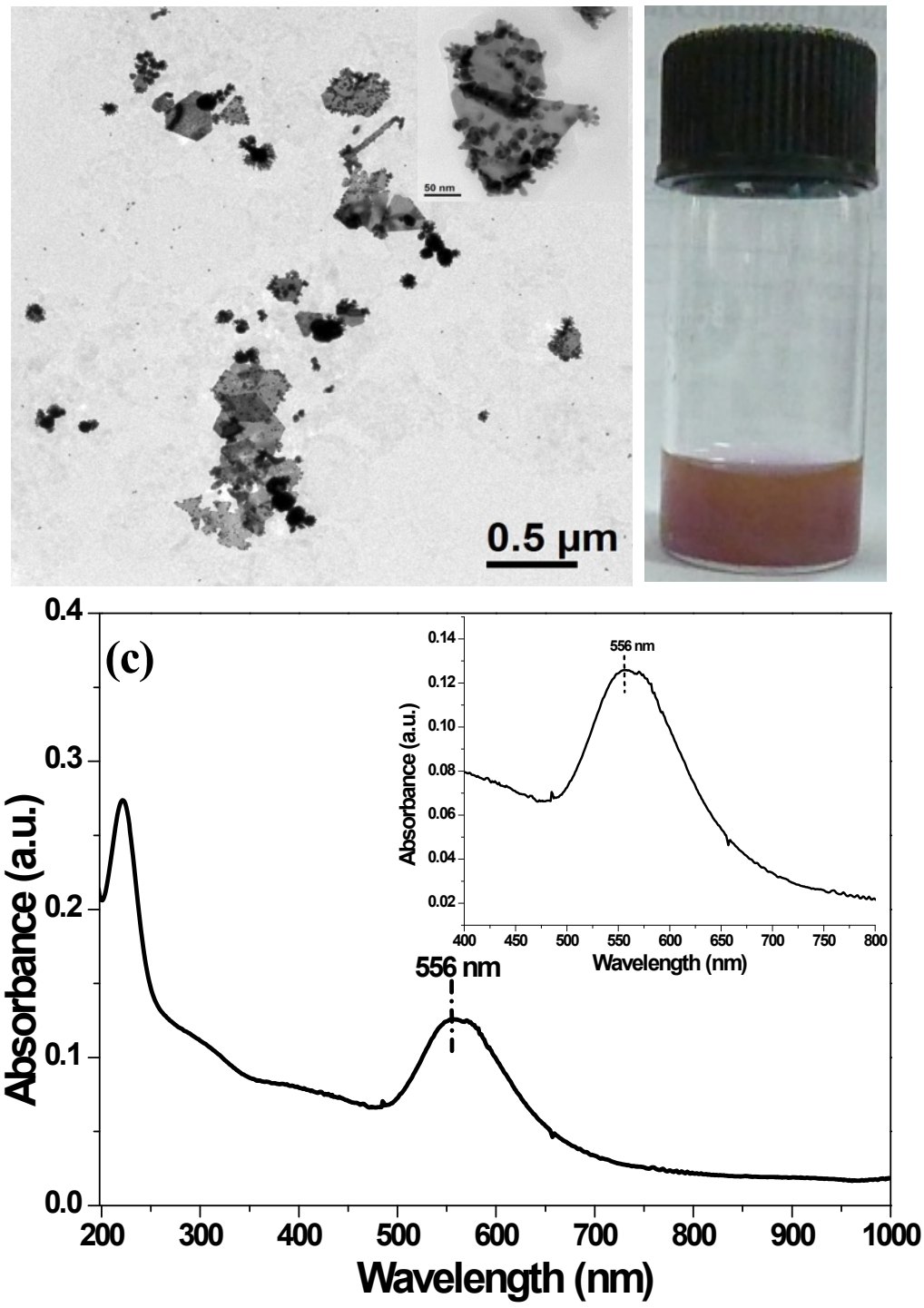

Fig.S2 (a) TEM image of CA stabilized gold seed solution (Au-240) recorded after 4 hrs of reaction; (b) Corresponding digital picture of same solution, (c) UV-Vis spectra of same solution, synthesized at room temperature with CA to $HAuCl_4$ molar ratio was also 1:1.

Synthesis of Au/PANI nanostructures from different Au seed solution (Au-60 and (Au-240)

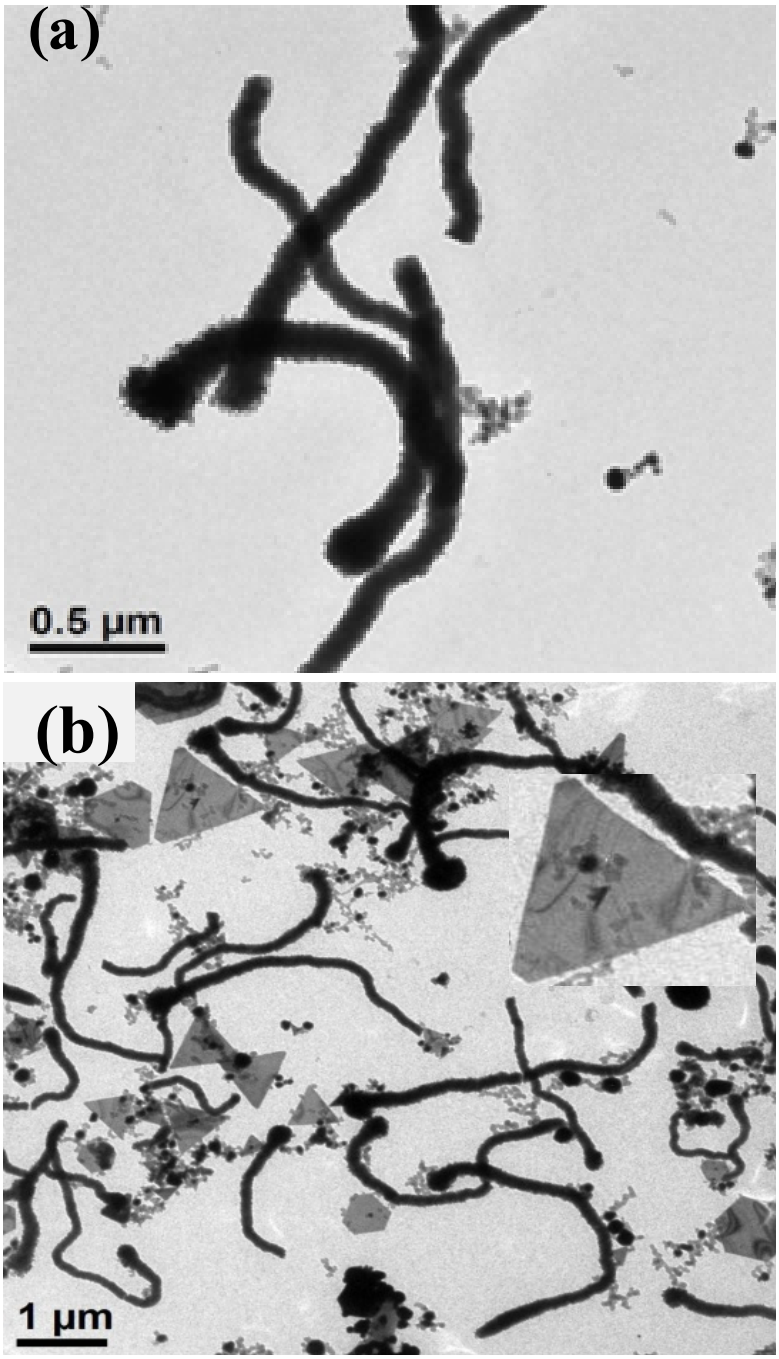

Fig.S3 (a) TEM image of Au/PANI nanostructures synthesized from Au-60 seed solution (b) and synthesized from Au-240 seed solution at room temperature (25 ^{o}C).

Aspect ratio of finger shaped Au-nanoparticles

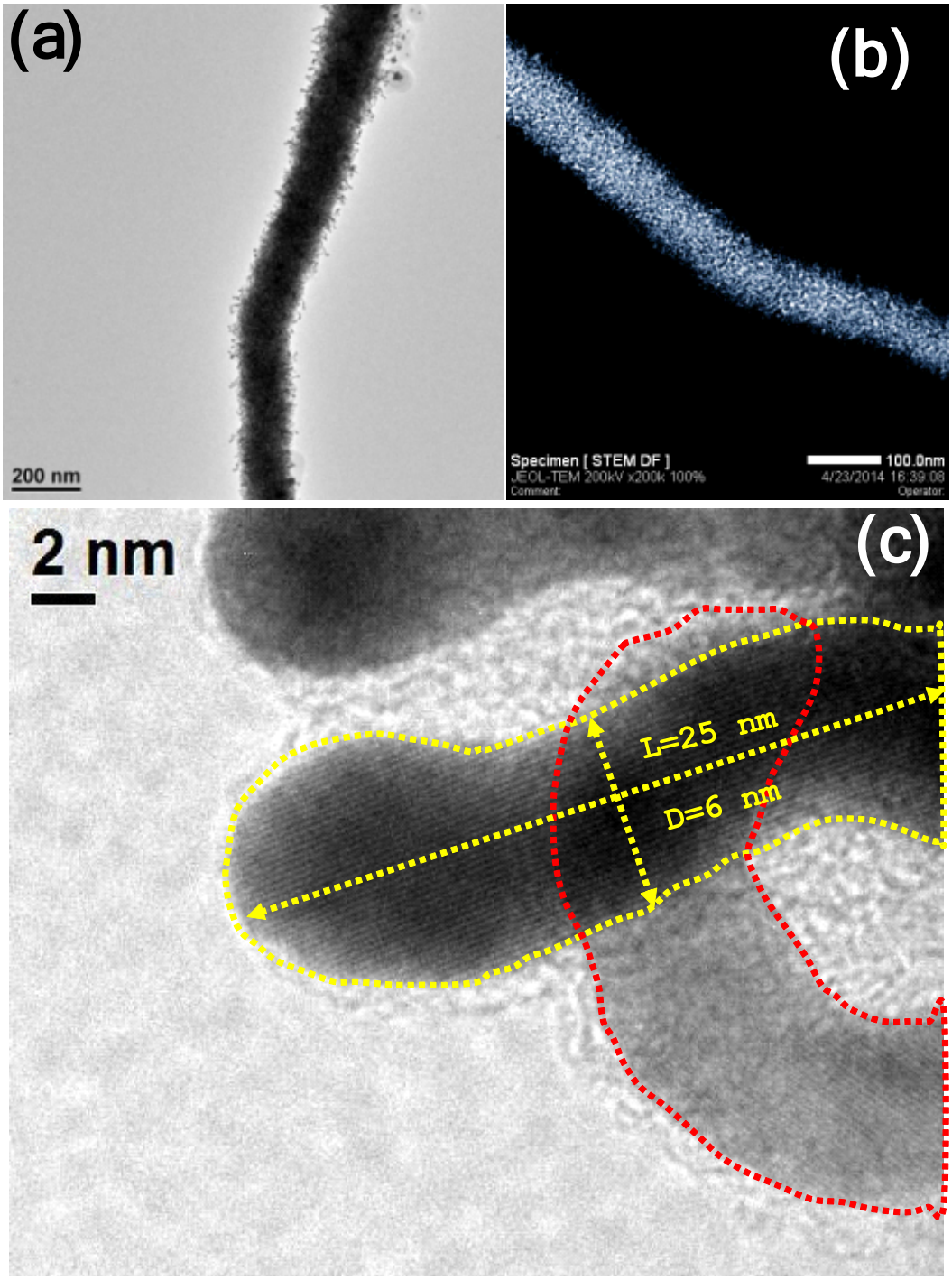

Fig.S4 (a) Bright field TEM image single nanofiber of Au/PANInanostructures, (b) Dark field image of same nanofiber and (c) Length and diameter of single finger shaped Au-nanoparticle synthesized at room temperature.

Au-nano formation kinetics

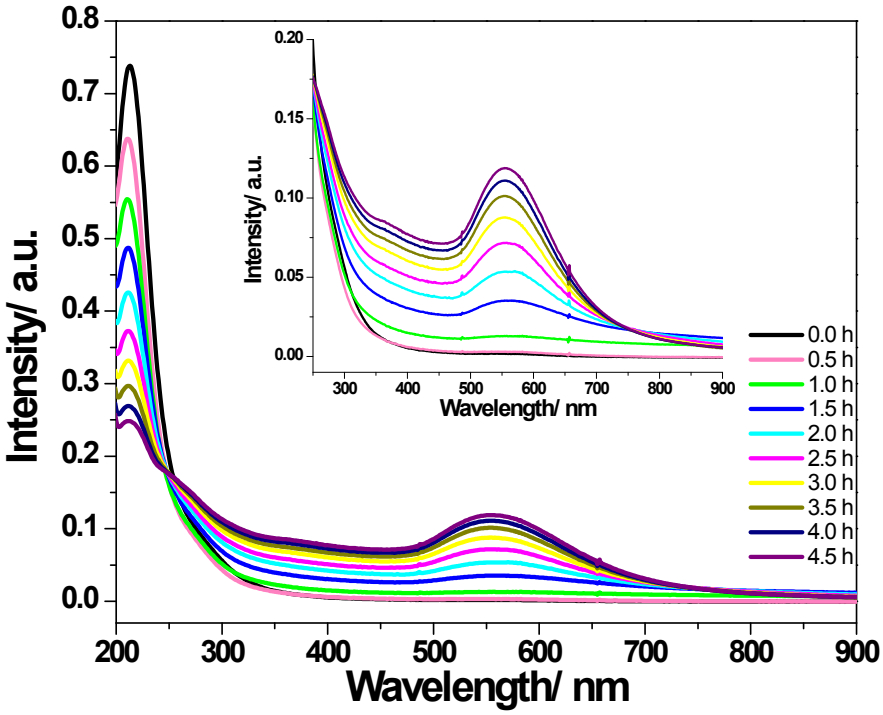

Fig.S5 Au-nano formation kinetics at room temperature where CA to $HAuCl_4$ molar ratio was 1:1.

4-Nitropheol reduction by sodium borohydride (without any catalyst)

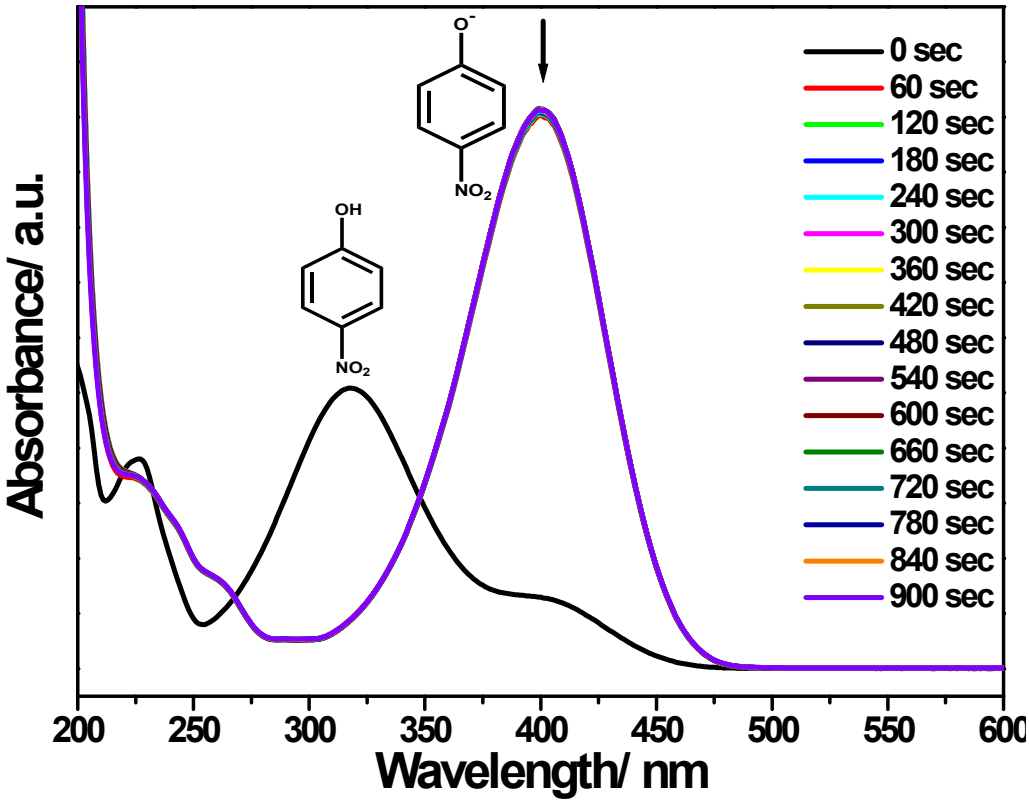

Fig.S6 Reduction of 4-Nitrophenol by $NaBH_4$ at room temperature (25 ^oC).

4-Nitroaniline (4-NA) reduction

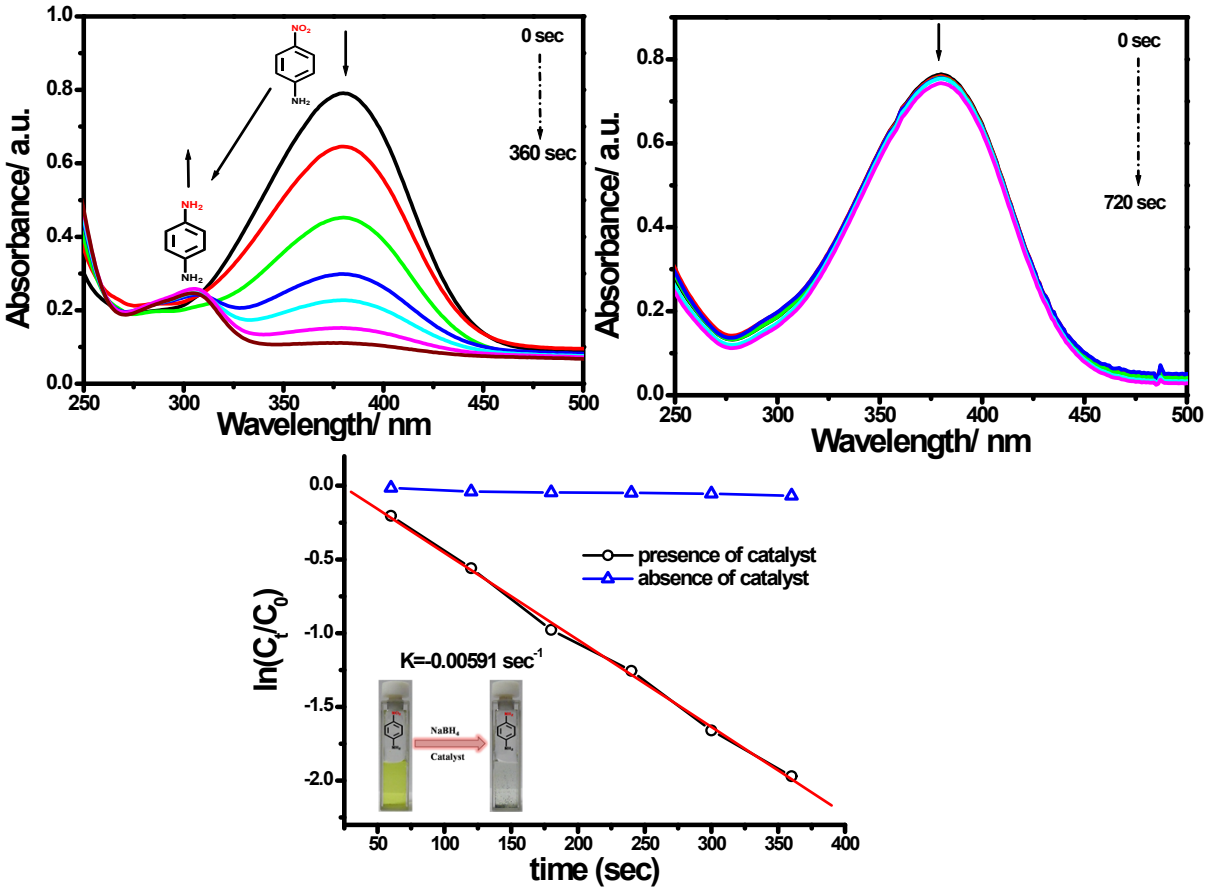

Fig.S7 UV-Vis spectra of 4-NA reduction by using Au/$PANI_{1.0}$ nanostructures in water at 25 ^{o}C

Procedure:

A similar reduction pattern for *p*-nitro amine (*p*-NA) 2,4-dinitrophenol (2,4-DNP) and 2,4,6-trinitro phenols (2,4,6-TNP) is also observed by using Au/$PANI_{1.0}$ nanostructures as good heterogeneous catalyst than the othersnanostructures. The rate of reaction for 4-nitroamine reduction is 0.00591 sec^{-1}. Where peak centred at 380 nm is for 4- nitro aniline after treating with $NaBH_4$ aqueous solution in presence of Au/PANI composite as a catalyst a new peak generated at 306 nm is for 4-amino aniline.

2,4-Dinitro phenol reduction (2,4-DNP) reduction

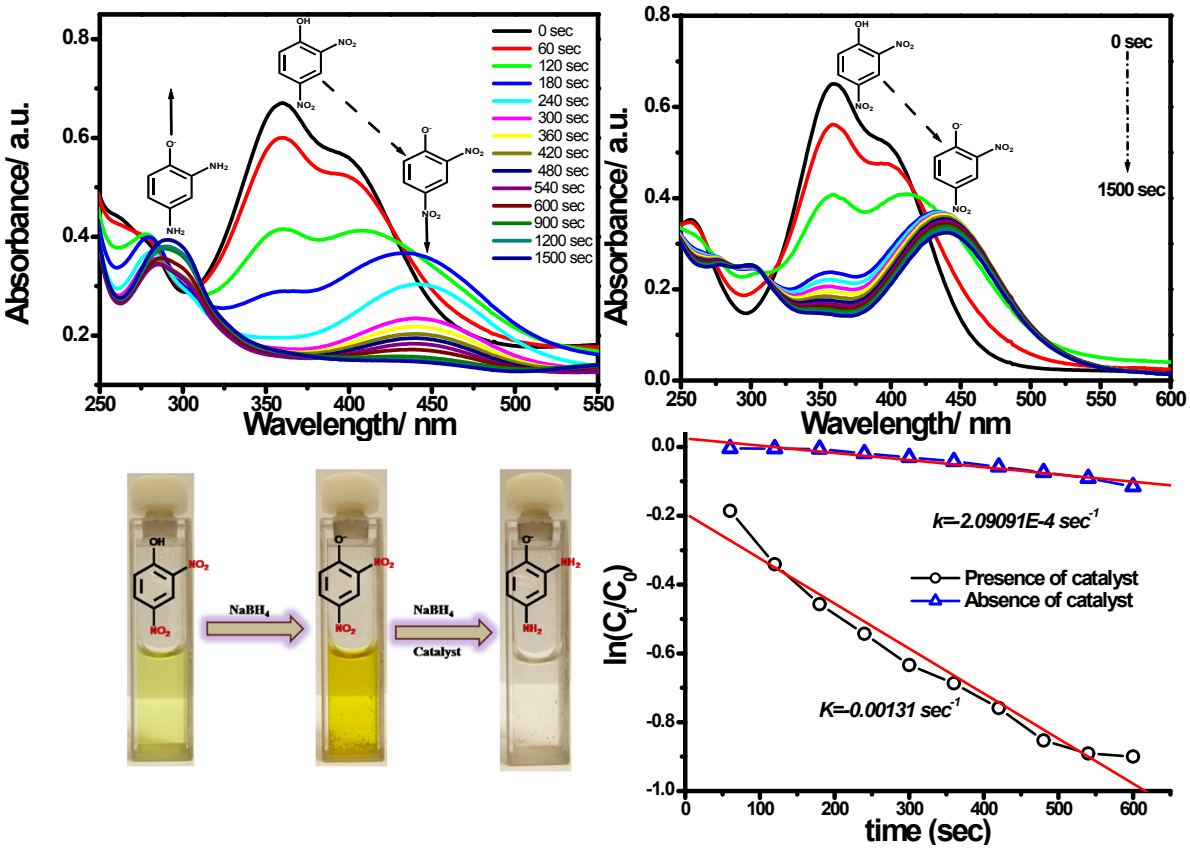

Fig.S8 UV-Vis spectra of 2,4-DNP reduction by using Au/$PANI_{1.0}$ nanostructures in water at 25 ^{o}C

Procedure:

In case of 2,4-di-nitro phenol (2,4-DNP) peak centred at 360 nm after treating with freshly prepared $NaBH_4$ aqueous solution peak maxima shifted towards 445 nm which gradually decreases and finally try to attend minimum subsequently 2,4-di-amine peak increase at ~298 nm in presence of Au/$PANI_{1.0}$ nanostructures as a catalyst with reaction rate 0.00131 sec^{-1}.

2,4,6-trinitro phenol reduction (2,4,6-TNP) reduction[S1]

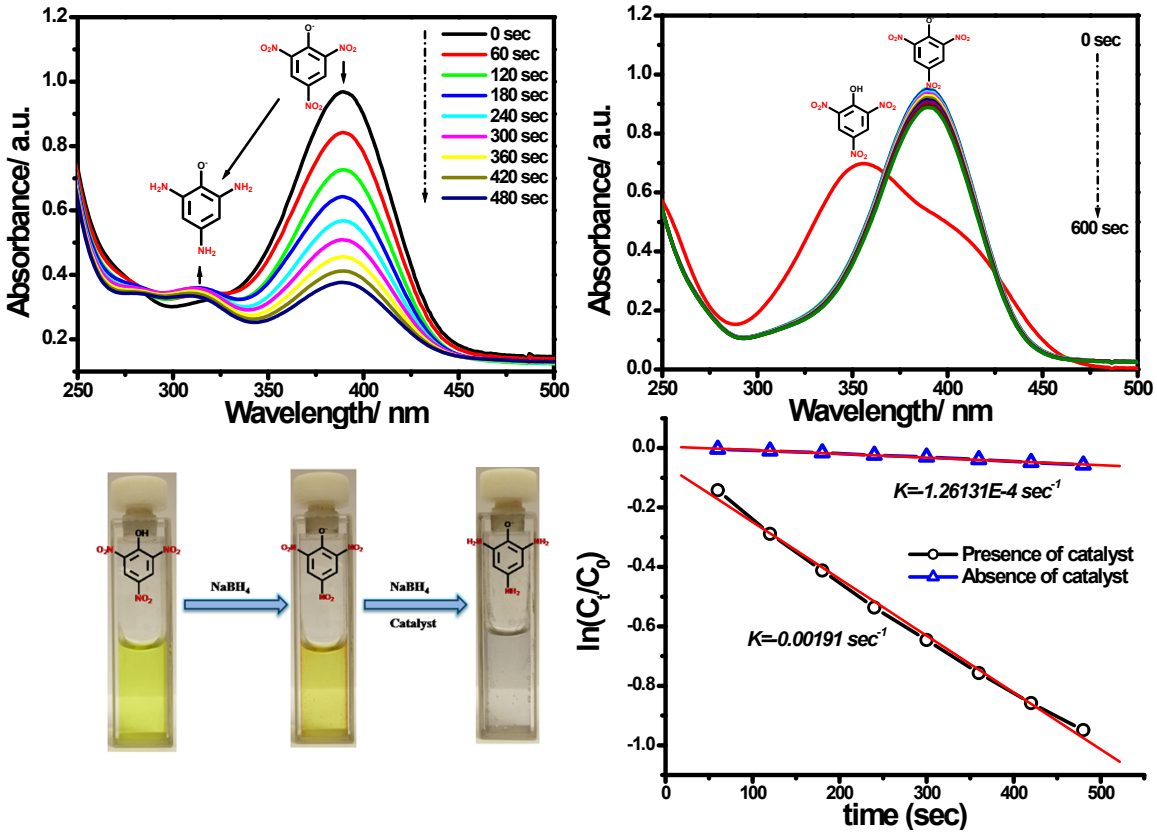

Fig.S9 UV-Vis spectra of 2,4,6-TNP reduction by using Au/PANI$_{1.0}$ nanostructures in water at 25 ^{o}C

Procedure:

Similarly in case of 2,4,6-tri-nitro phenolate ion absorbance maxima centred at 390 nm which shifted towards ~315 nm for 2,4,6-triamino phenolate ion after treating with $NaBH_4$ in presence of Au/PANI$_{1.0}$ nanostructures as a catalyst with 0.00191 sec^{-1} reaction rate.

References:

S1. S. Kaur, V. Bhalla, V. Vij, and M. Kumar, *J. Mater. Chem. C*, 2014, **2**, 3936.