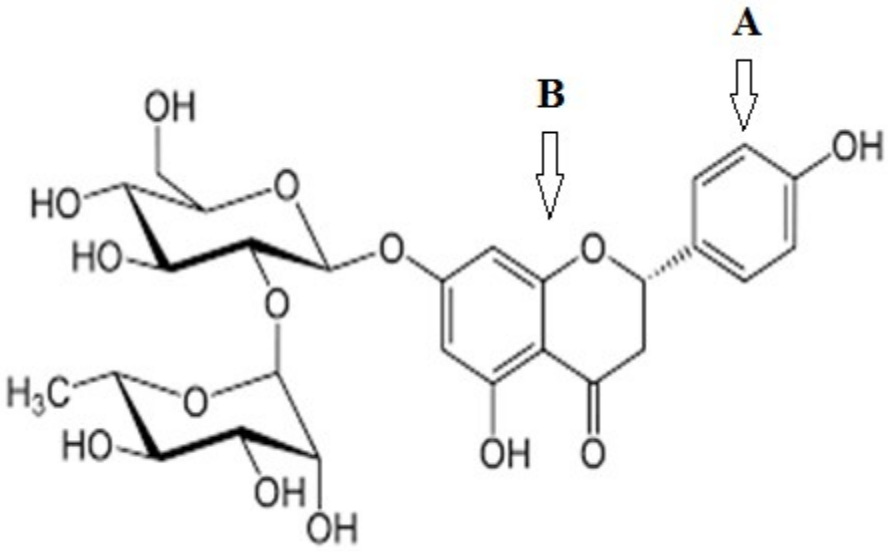
Figure SI-1

(a)



(b)

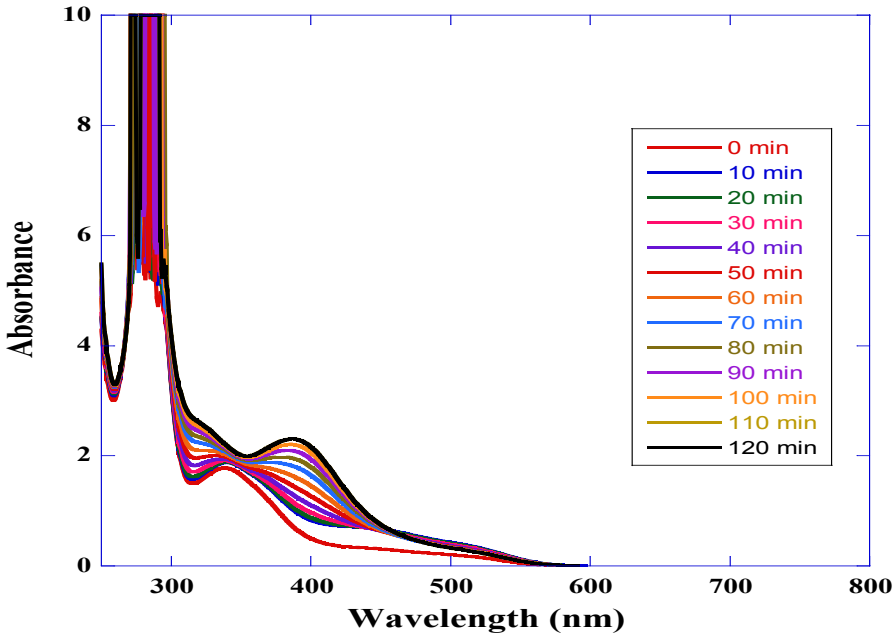
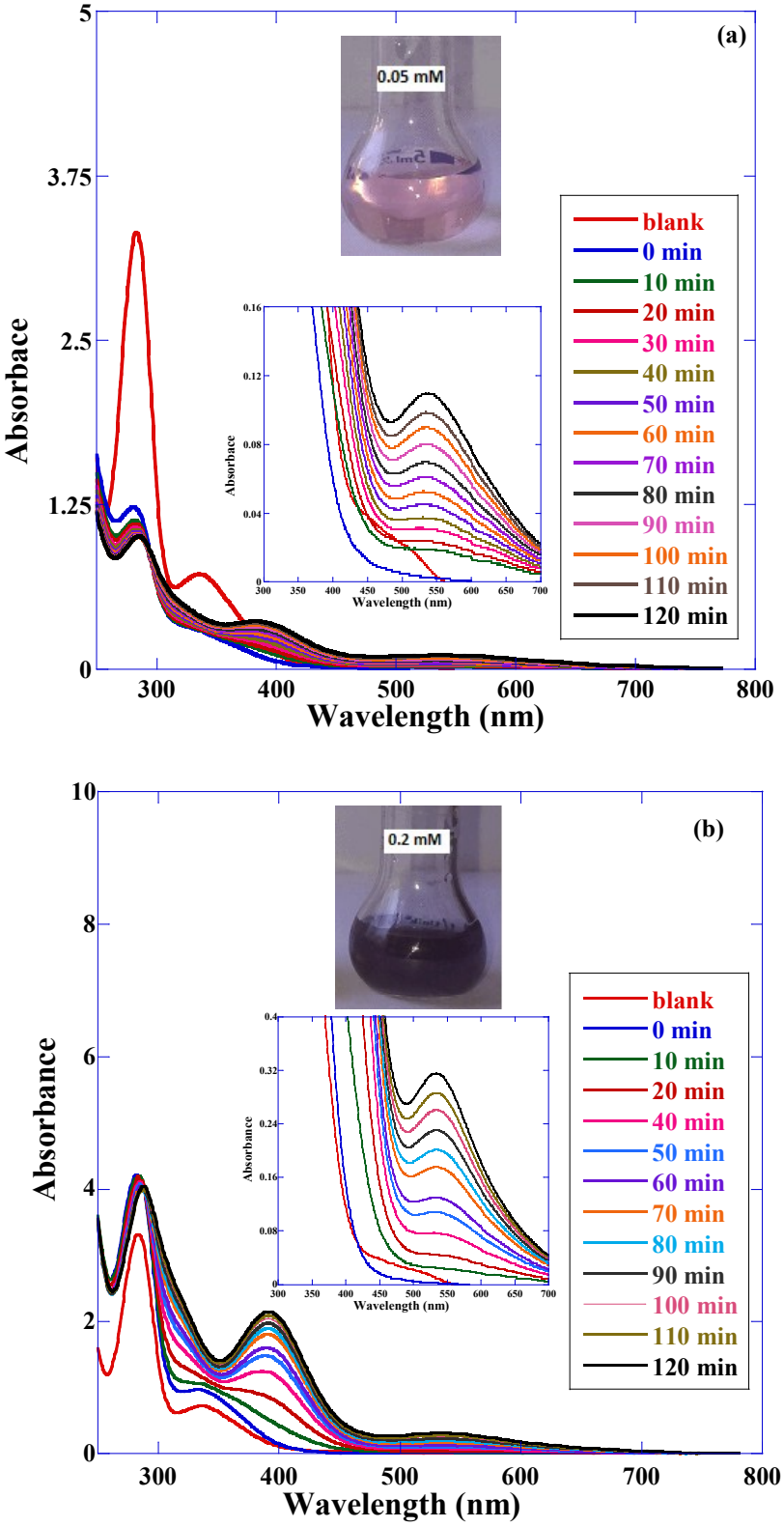


Figure SI-1 Figure S1a Molecular structure of Naringin with side chains marked as A and B. Figure S1b UV- Vis scan of absorbance versus wavelength of pure Naringin, [N] = 0.5mM in a buffer of pH 9.

Figure SI-2


(a)
0.05 mM
Absorbace
Wavelength (nm)
blank
0 min
10 min
20 min
30 min
40 min
50 min
60 min
70 min
80 min
90 min
100 min
110 min
120 min
(b)
0.2 mM
Absorbance
Wavelength (nm)
blank
0 min
10 min
20 min
40 min
50 min
60 min
70 min
80 min
90 min
100 min
110 min
120 min

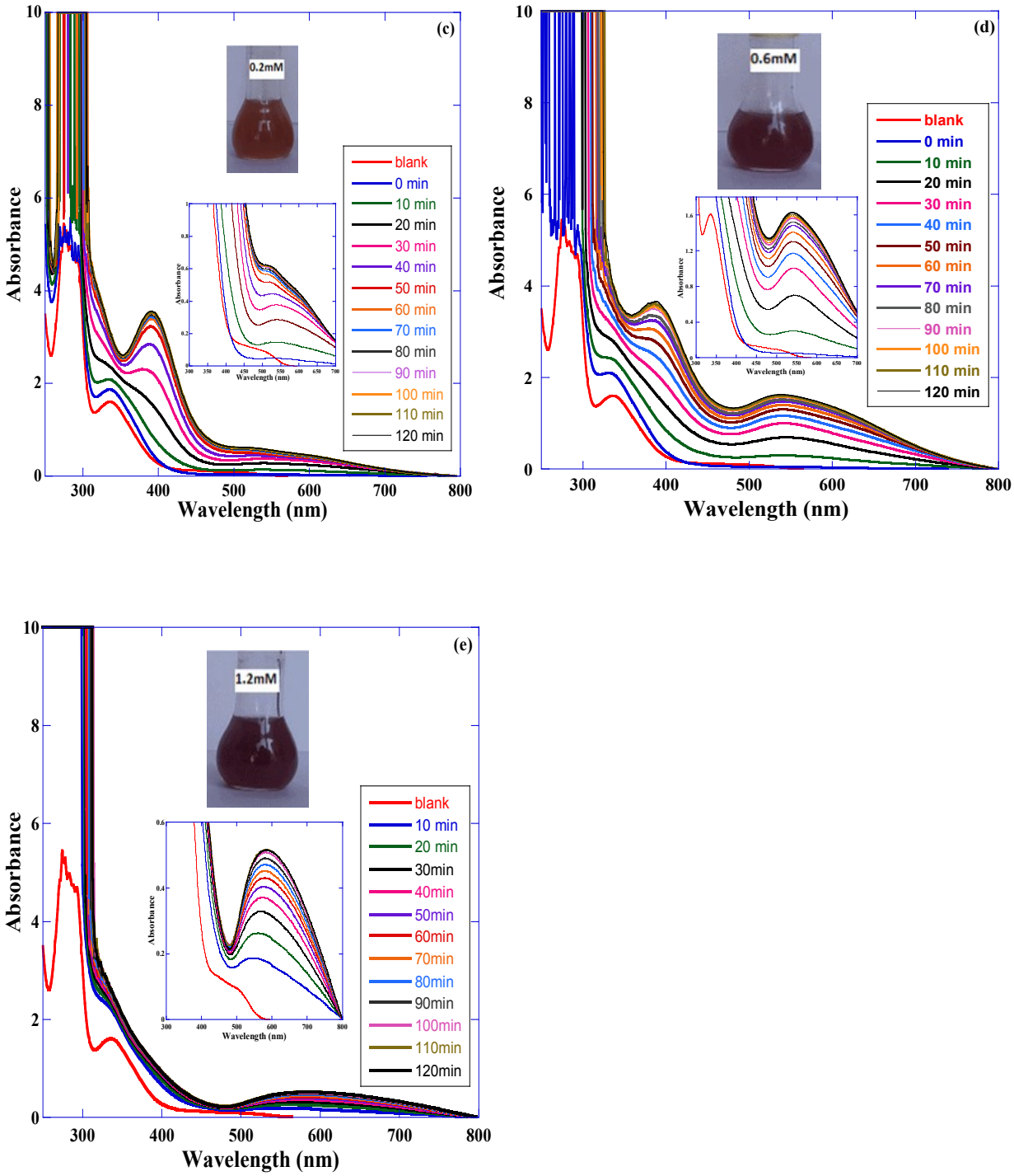


Figure SI-2 UV-Visible spectra of $HAuCl_4$ +Naringin mixture in a buffer of pH 9 with [$HAuCl_4$] = 0.4mM and [N] = 0.05 (2a), 0.2mM (2b) at 40°C. UV-Visible spectra of $HAuCl_4$ +Naringin mixture with [N] = 0.5mM and [Au] = 0.2 (2c), 0.6 (2d), 1.2mM (2e) at 40°C. Blank means no Naringin is added. All the inset shows the SPR peak and colour of AuNPs in each case.

Figure SI-3

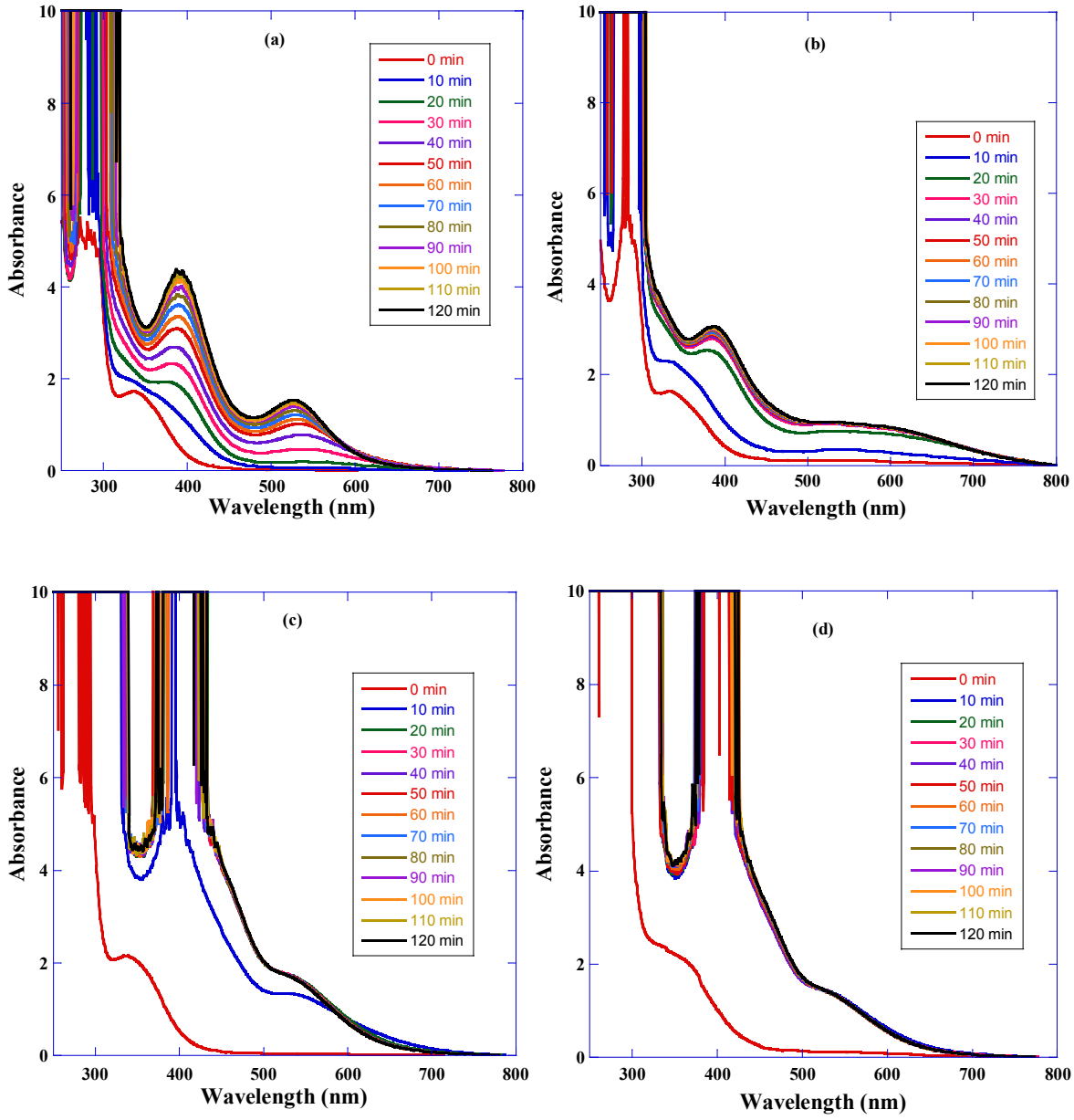


Figure SI-3: Absorbance versus wavelength scans of [$AuCl_4$] = 0.4mM + [N] = 0.5mM at various temperatures. (a) 40°C (b) 50°C (c) 60°C (d) 70°C over a time interval of 120 minutes.

Figure SI-4

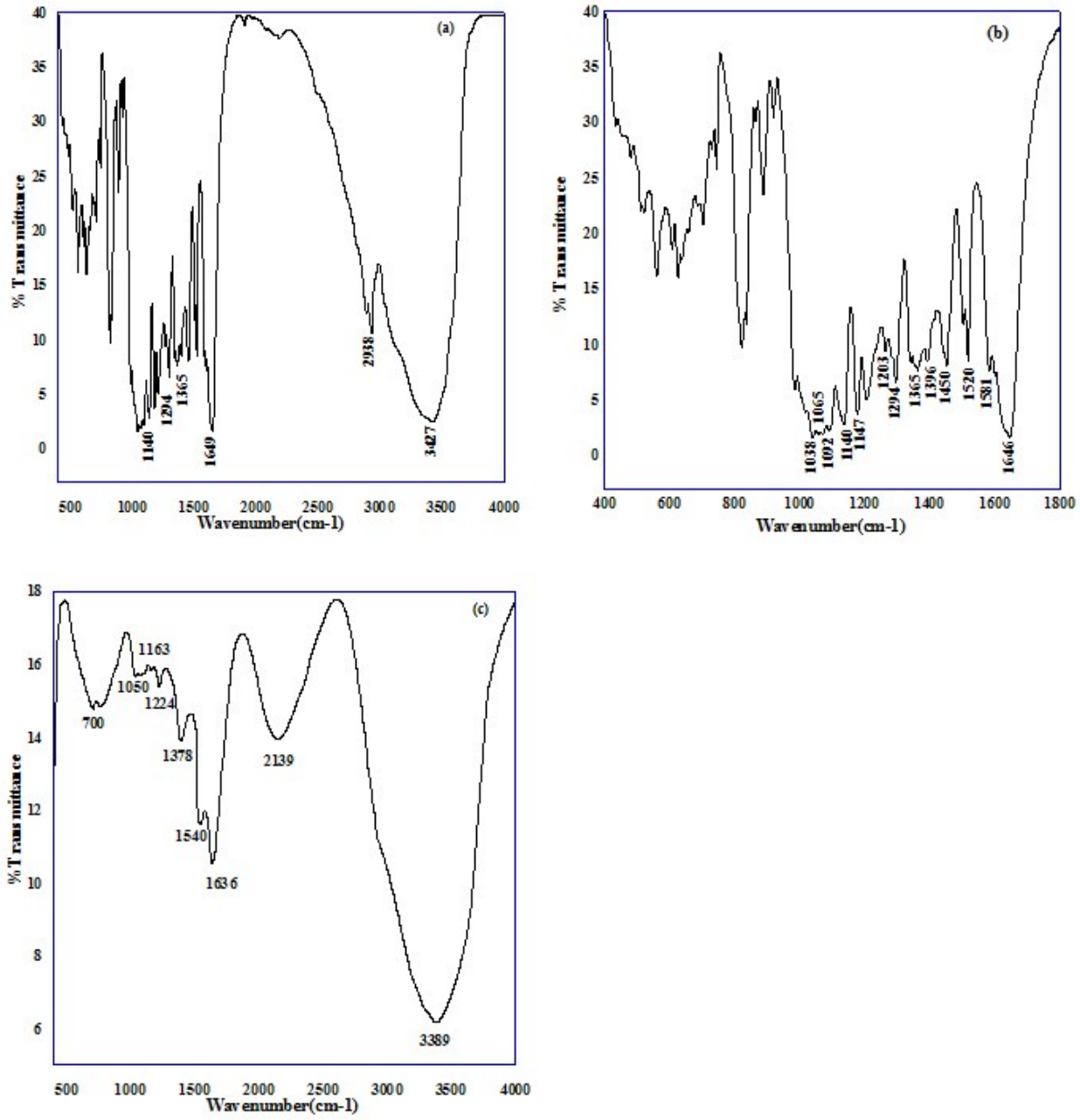


Figure SI-4: FTIR spectra of (a) Pure Naringin (b) enlarged view of peaks of Pure Naringin from 400-1800 cm^{-1} (c) Naringin stabilized AuNPs.

Figure SI-5

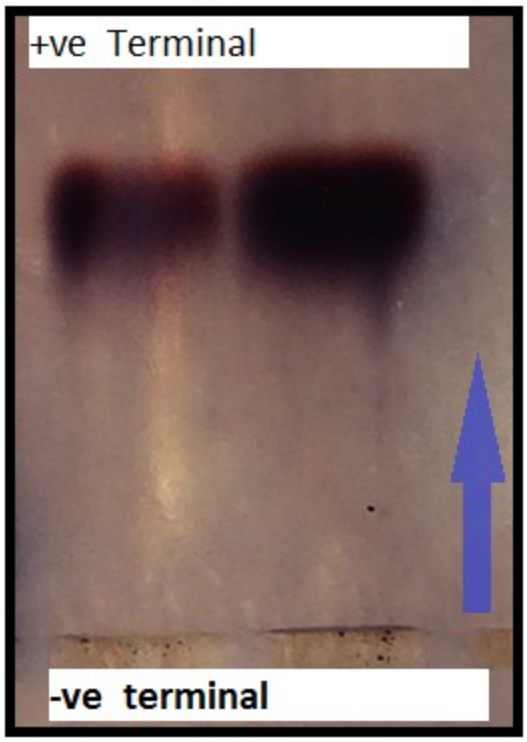


Figure SI-5: Image of gel-electrophoresis of N-AuNPs.

Figure SI-6

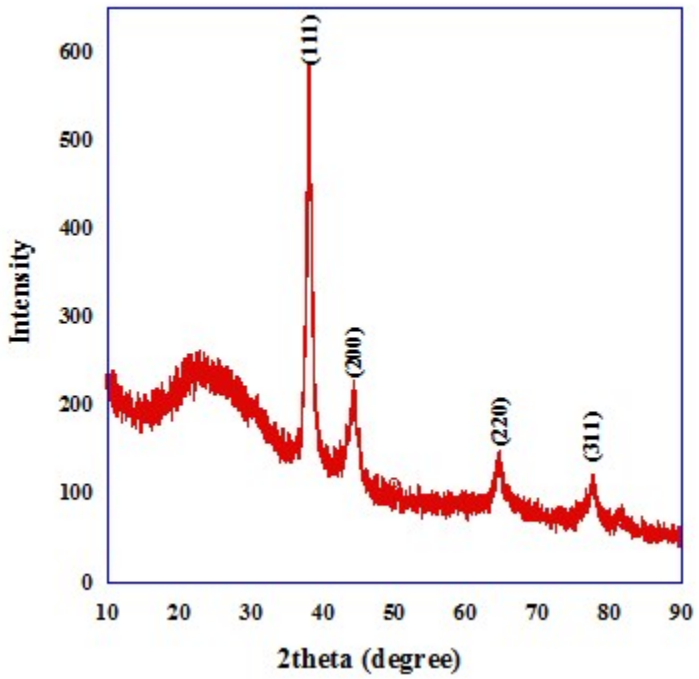
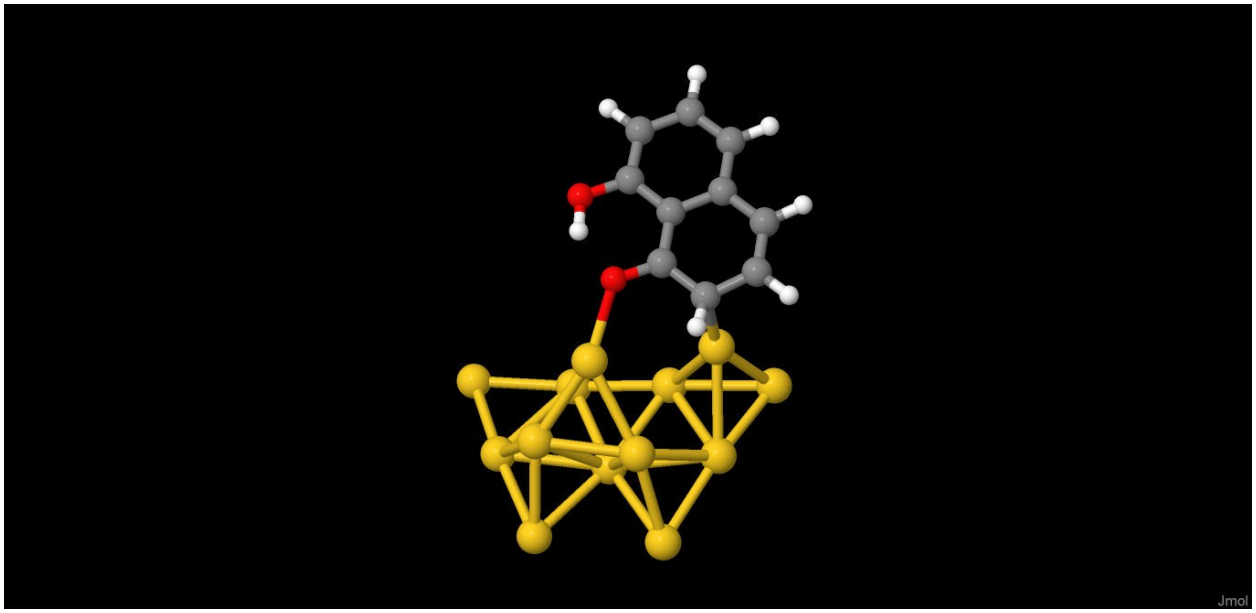


Figure SI-6: XRD spectrum illustrating the crystalline nature of N-AuNPs.

Figure SI-7

(a)



(b)

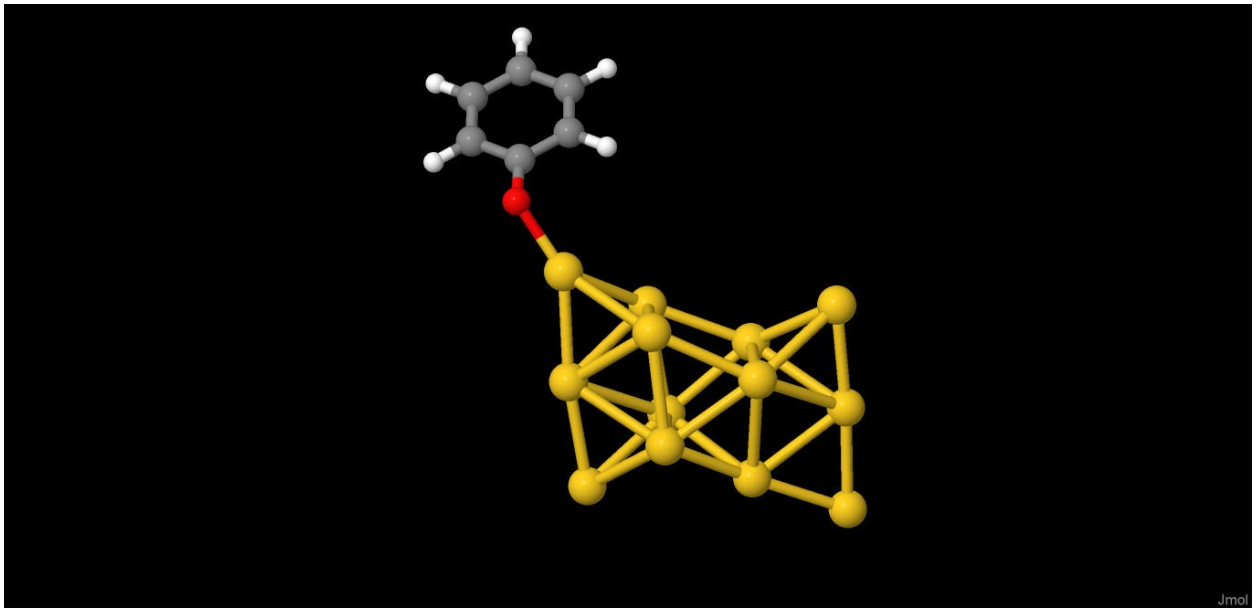
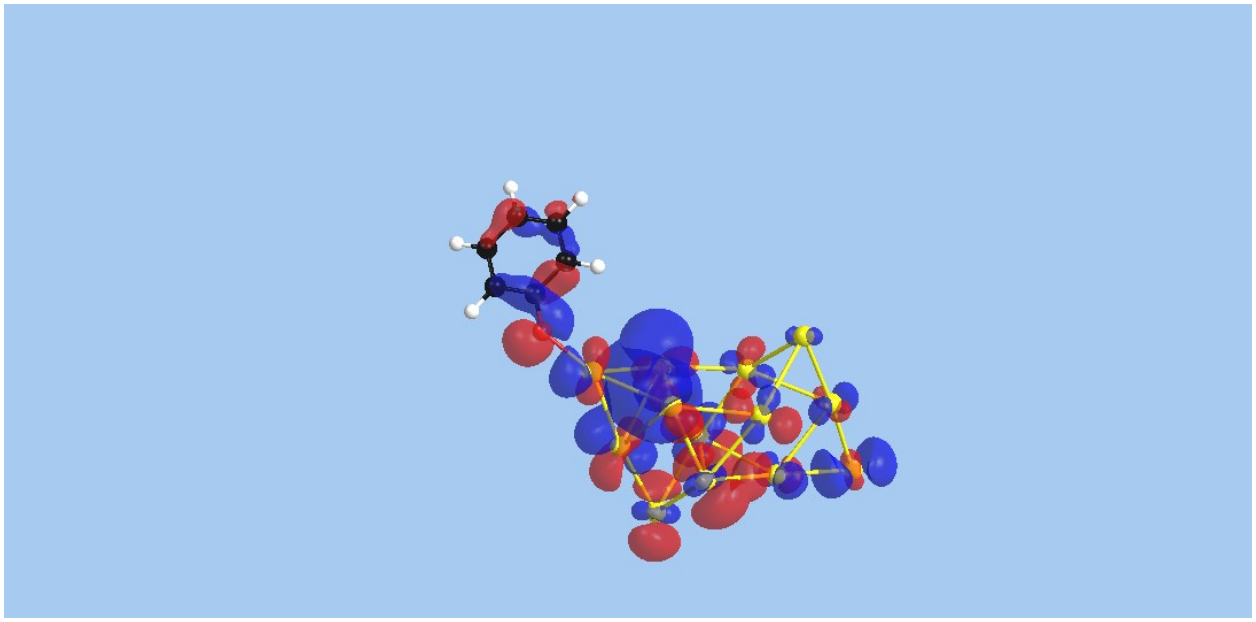


Figure SI-7: Minimum energy structure of (a) $[C_{10}H_7O_2]$ adsorbed on Au_{13} cluster and (b) $[C_6H_5O]^-$ adsorbed on Au_{13} cluster (Yellow spheres represent Au, Black C, white H and Red O.

Figure SI-8

(a)



(b)

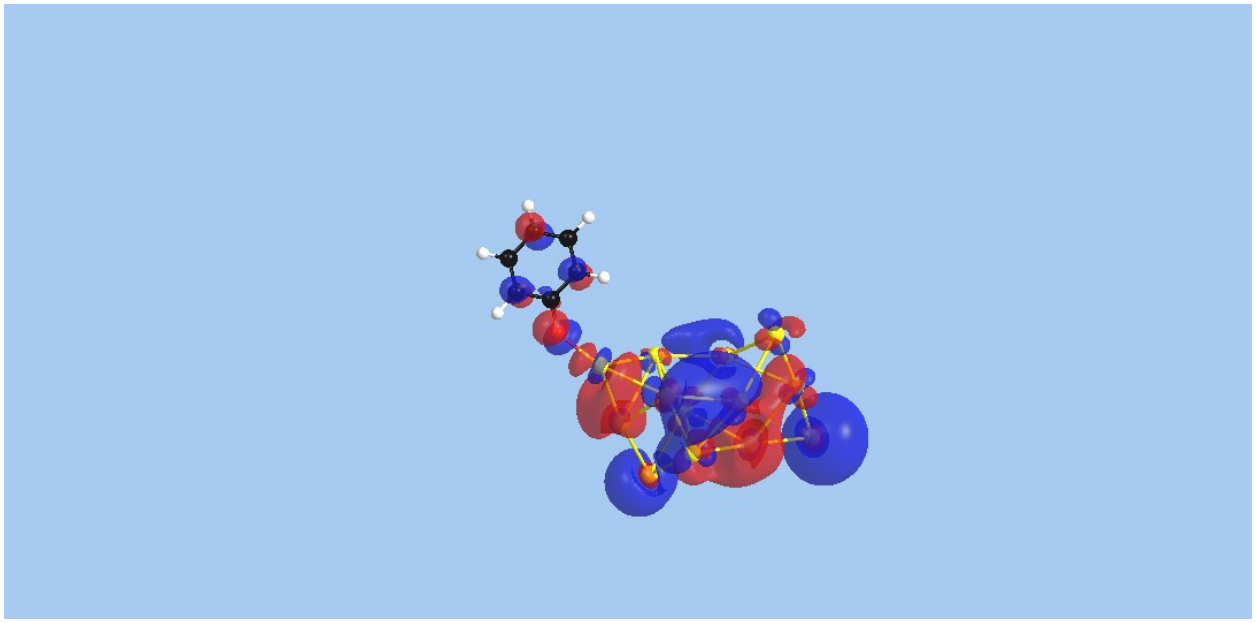
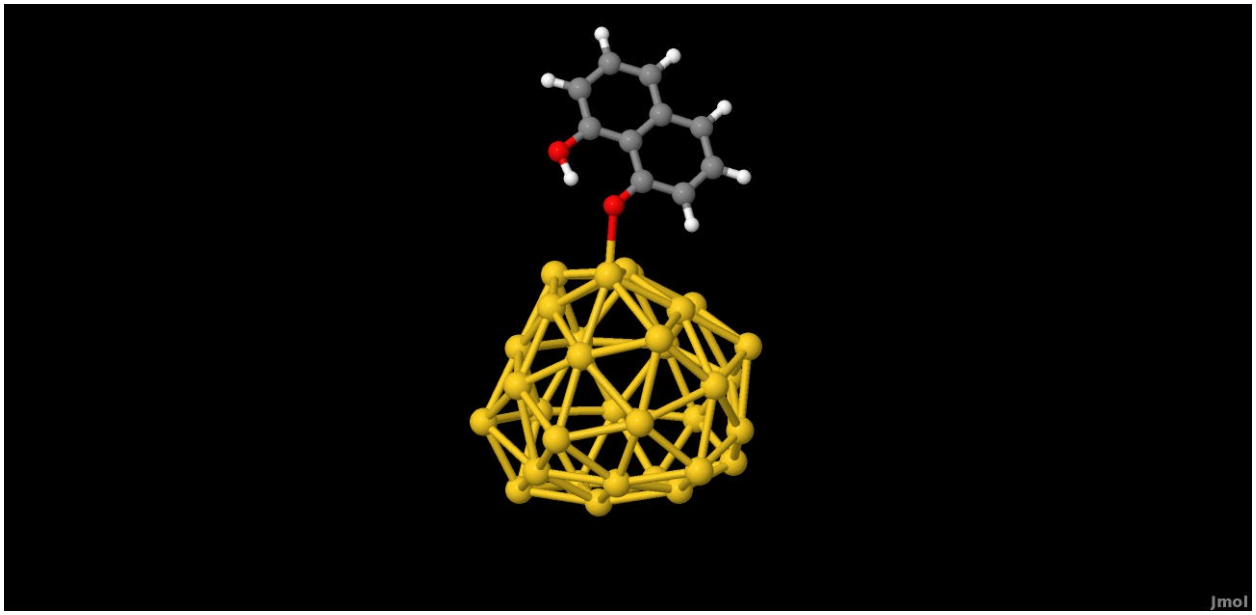


Figure SI-8: NTOs for the excitations which make up the dominant peak in the Vis region (a) Hole part and (b) Particle part of $[C_6H_5O]^-$-Au_{13}. Phases of the orbitals are indicated in red and blue.

Figure SI-9

(a)



(b)

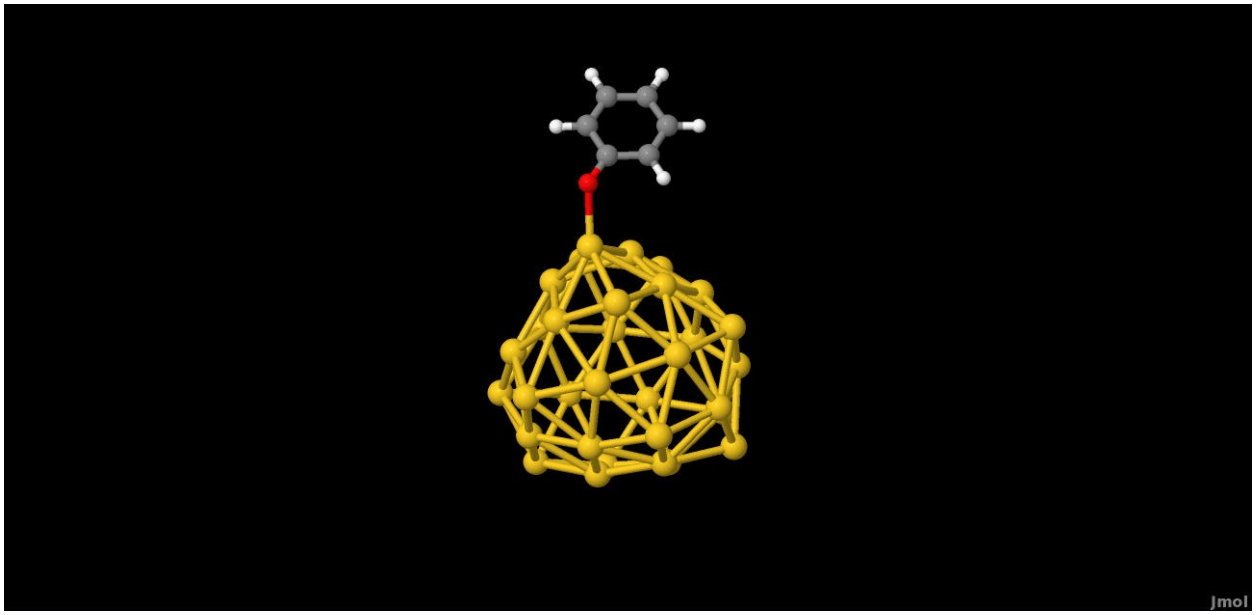
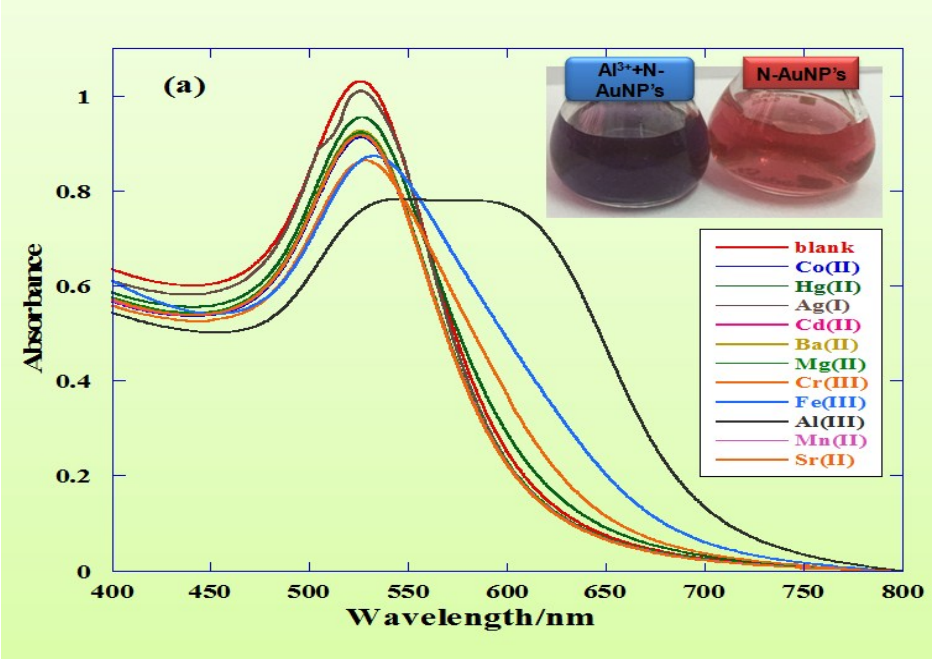
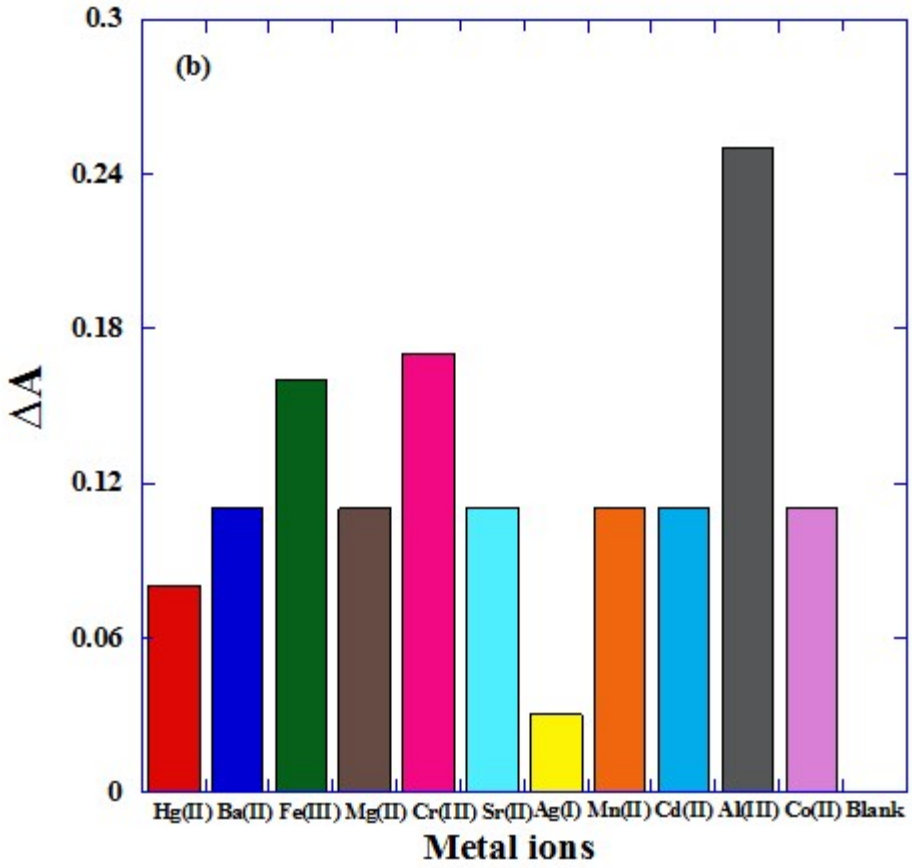


Figure SI-9: Minimum energy structure of (a) $[C_{10}H_7O_2]$ adsorbed on Au_{32} cluster and (b) $[C_6H_5O]^-$ adsorbed on Au_{32} cluster.

Figure SI-10


(a)
Al3+ +N-AuNP's
N-AuNP's
blank
Co(II)
Hg(II)
Ag(I)
Cd(II)
Ba(II)
Mg(II)
Cr(III)
Fe(III)
Al(III)
Mn(II)
Sr(II)
Absorbance
Wavelength/nm
0
0.2
0.4
0.6
0.8
1
400
450
500
550
600
650
700
750
800


(b)
ΔA
Metal ions
0
0.06
0.12
0.18
0.24
0.3
Hg(II)
Ba(II)
Fe(III)
Mg(II)
Cr(III)
Sr(II)
Ag(I)
Mn(II)
Cd(II)
Al(III)
Co(II)
Blank

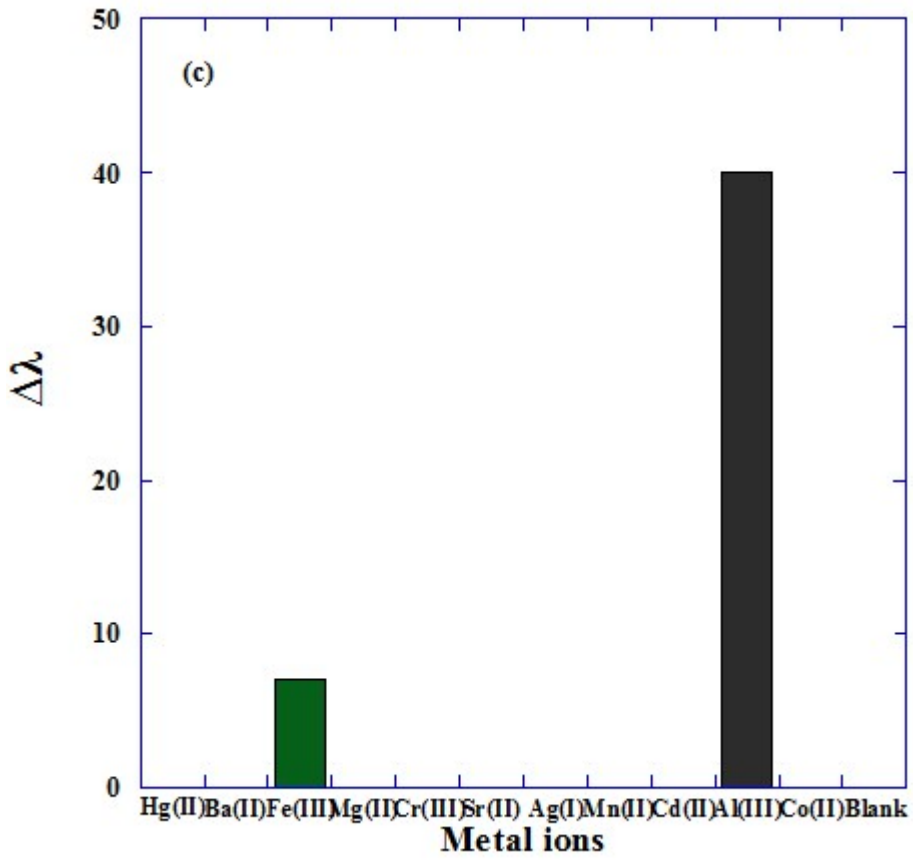


Figure SI-10: (a) UV-Visible absorbance spectra of N-AuNPs with various metal ions. Inset shows a photograph representing the N-AuNPs solution and its response towards Al^{3+}. (b) The bars represent the calorimetric response of N-AuNPs with various metal ions in terms of change in absorbance ΔA with respect to the blank i.e. N-AuNPs. (c) The bars represent the calorimetric response of N-AuNPs with various metal ions in terms of change in wavelength Δλ with respect to the blank i.e. N-AuNPs.

Figure SI-11

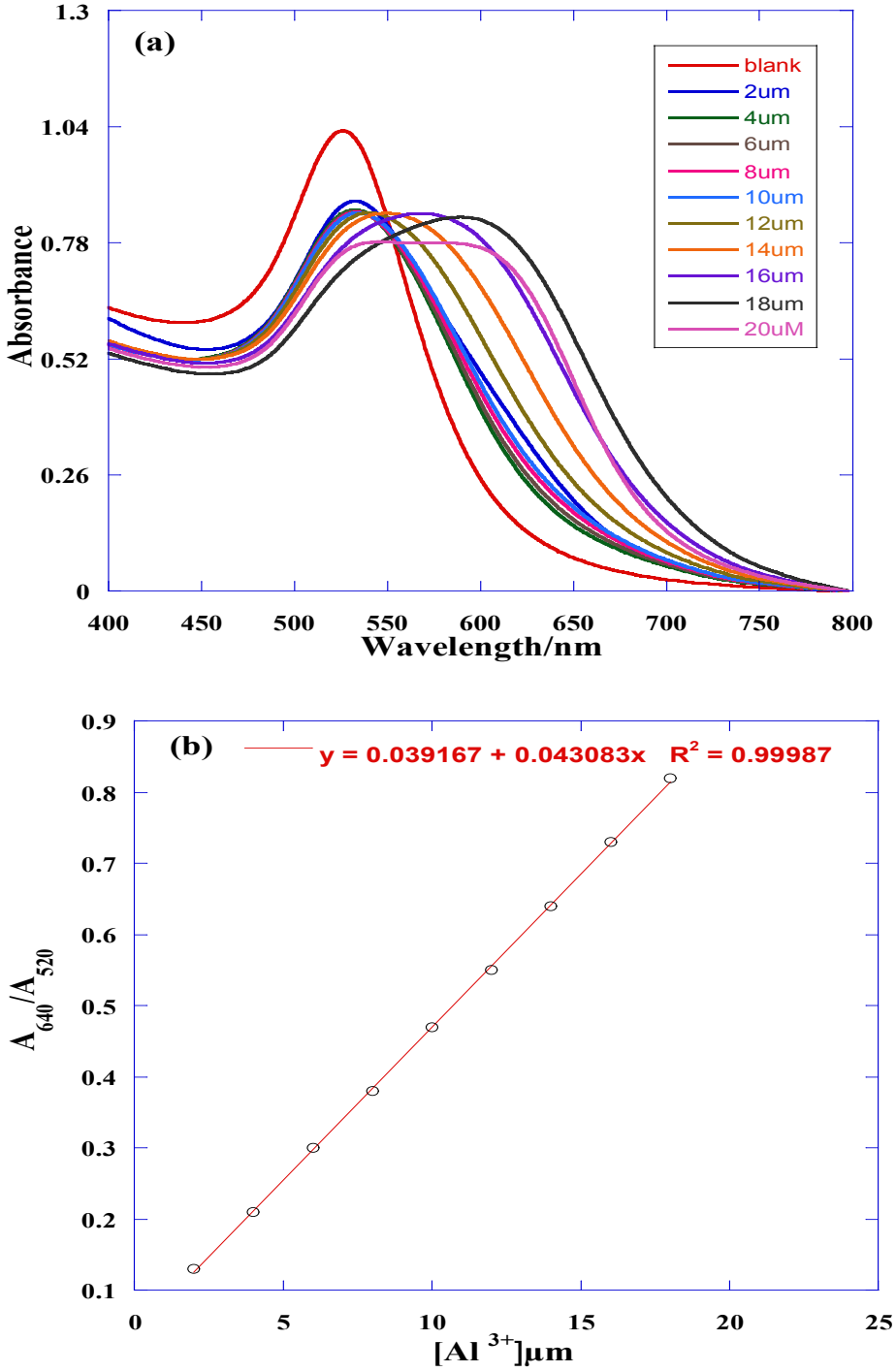


Figure SI-11: (a) UV-Visible spectrum of N-AuNPs as a function of various concentrations of Al^{3+} ions (b) plot of absorption ratios A_{640}/A_{520} of N-AuNPs versus Al^{3+} concentration.

Figure SI-12

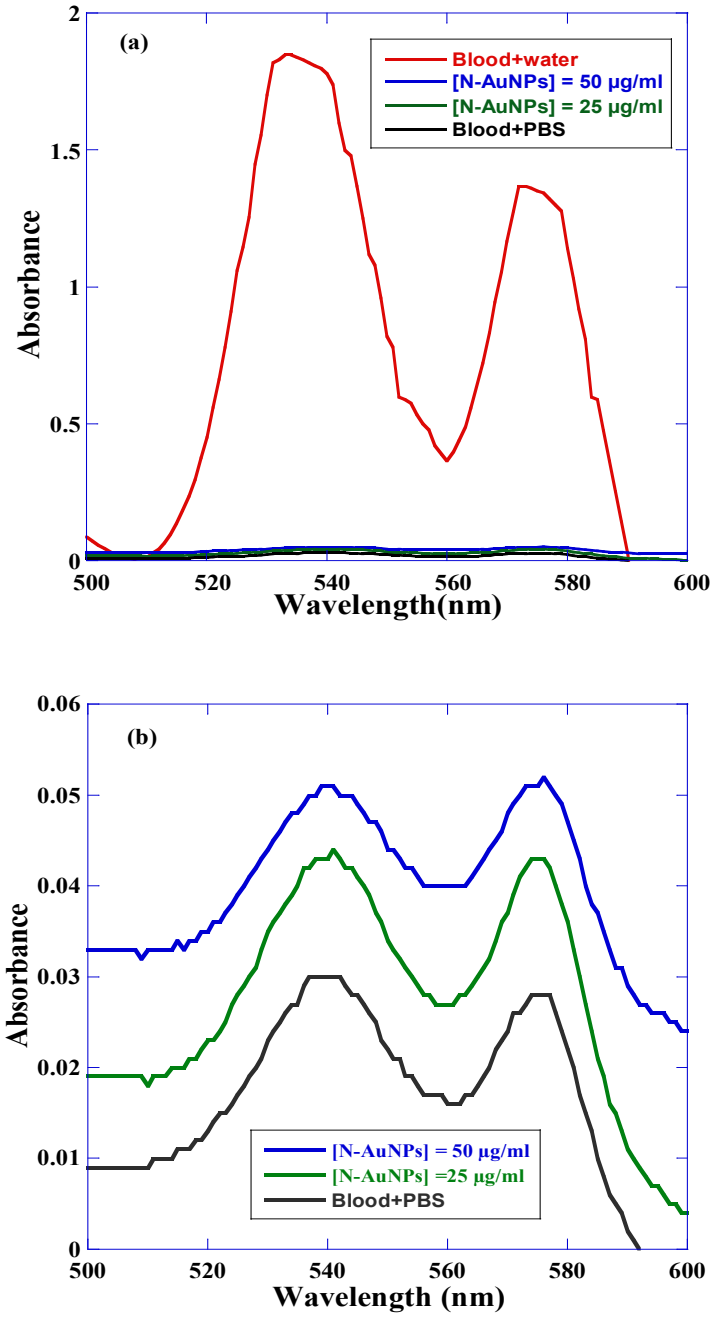


Figure SI-12: (a) Heme Absorption Spectra with different concentrations of N-AuNPs i.e. [N-AuNPs] = 25 and 50 µg/ml. (b) Enlarged view of Absorption peaks of heme from 500-600 nm.

Figure SI-13

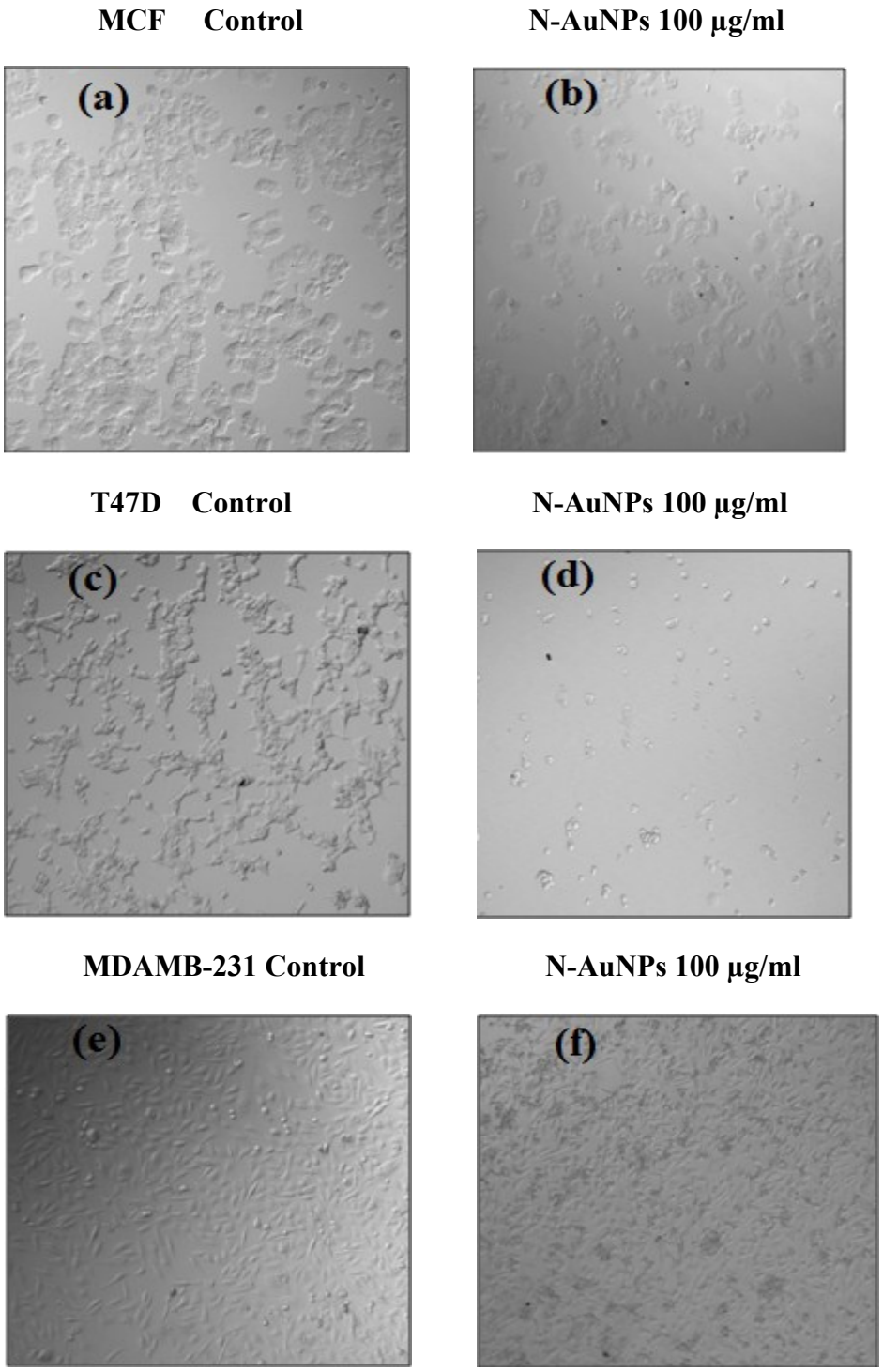


Figure SI-13: Laser Scanning microscope images of cell lines (a, c, and e) represents the morphology in untreated MCF-7, T47D , and MDAMB controls (b, d, and f) represents the changes in morphology in MCF-7, T47D, and MDAMB in the presence of [N-AuNPs] = 100 µg/ml.