Electronic Supplementary Material (ESI) for New Journal of Chemistry.

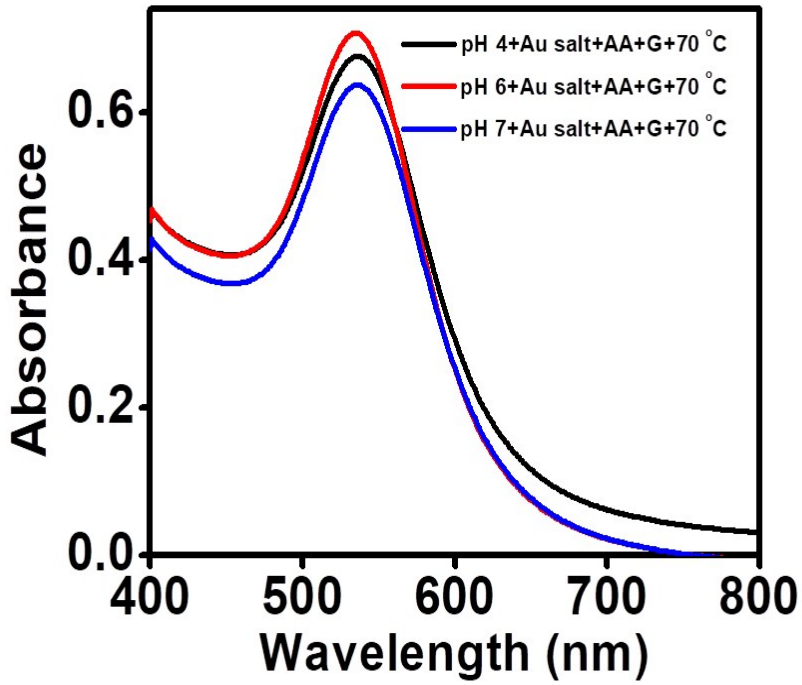
pH controlled one pot synthesis of gold nanostars by using zwitterionic protein hydrolysate (gelatin): Enhanced radio-sensitization of cancer cells

Ram Pada Das[1,2], Vishwa V. Gandhi[1,2], Beena G. Singh[1,2],*, Amit Kunwar[1,2]*
[1]Radiation & Photochemistry Division, Bhabha Atomic Research Centre, Trombay, Mumbai-400085, India
[2]HomiBhabha National Institute, Anushaktinagar, Mumbai –400094, India
E-mail : <beenam@barc.gov.in; kamit@barc.gov.in>

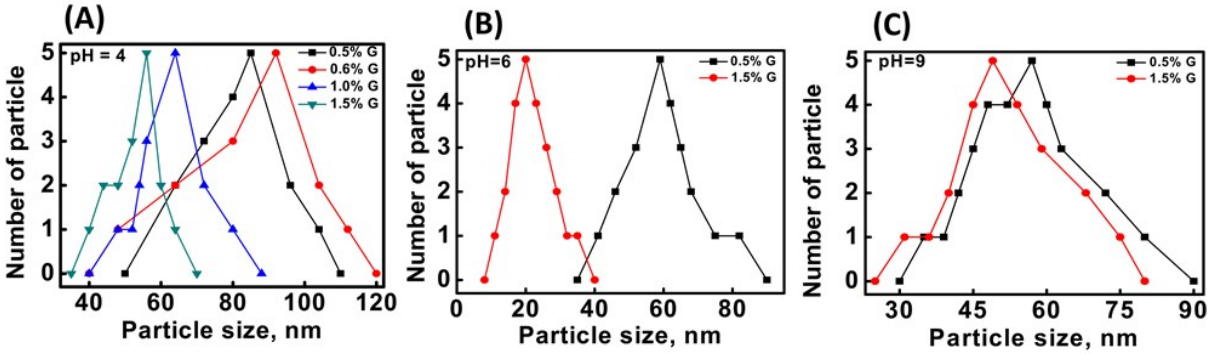
Supplementary method:

The storage stability of different shapes of gold nanoparticles (An NPs) was evaluated by monitoring their SPR spectrum and hydrodynamic size by DLS at different time intervals ranging from one to six months. The samples were stored in refrigerator at 4 °C for six months. Similarly, the stability of the An NPs was studied in presence of PBS and 10 % fetal bovine serum (FBS). In brief, first the DLS of the solvent containing 10% FBS was checked and the hydrodynamic size of the protein was measured. PBS solution did not show any scattering intensity. After that 0.5 ml of Au-NPs was mixed, separately with 2.5 ml PBS (1X)/10% FBS solution and the sample was allowed to incubate for 2 hrs. This was followed by estimation of hydrodynamic size by DLS.

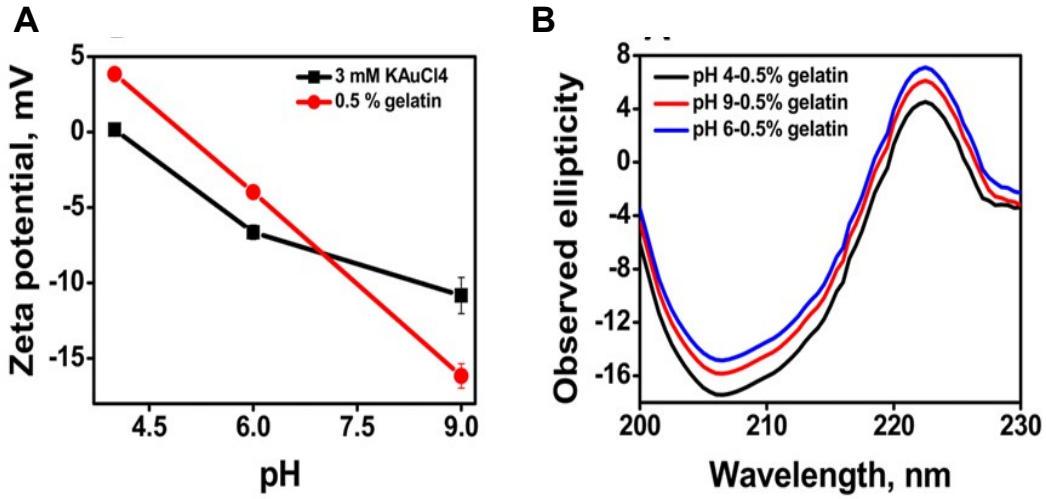
Supplementary Figures



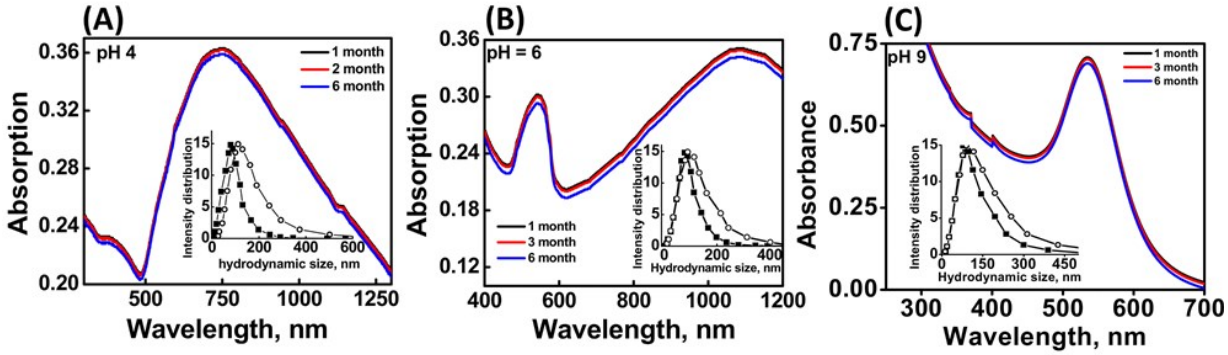
SFig. 1 Plots represent absorption spectra of gold nanoparticles formed by heating aqueous solution of 3 mM $KAuCl_4$, 10 mM ascorbic acid (AA), 0.5% gelatin at 70 °C and varying pHs 4, 6 and 9.



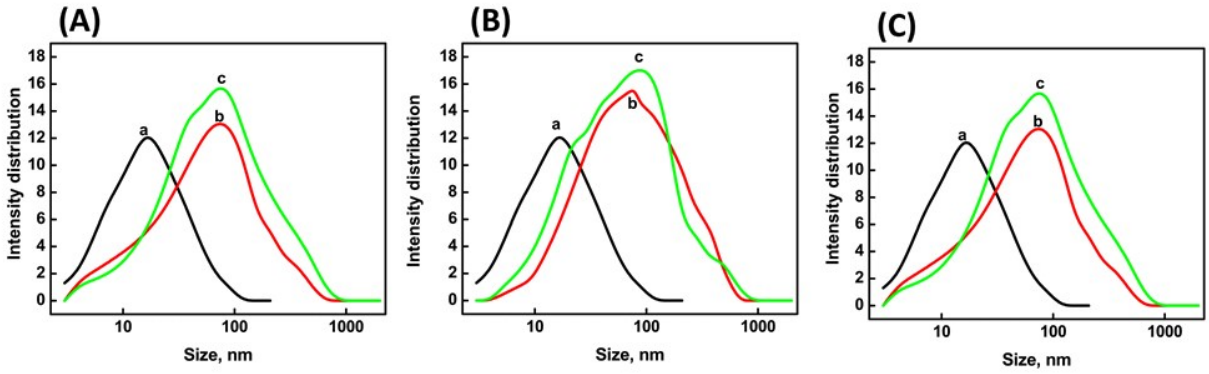
SFig. 2 Plots represent the size distribution as observed in the TEM images of the Au-NPs formed at pH 4 (A), pH 6 (B) and pH 9 (C).



SFig. 3 Plot A corresponds to variation in zeta potential value of gold salt and 0.5% gelatin as a function of pH 4, 6 and 9. Plot B represents circular dichroism spectra of gelatin at pH 4, 6 and 9.



SFig. 4 Figure depicting stability of different shapes of Au- nanoparticles formed in presence of 0.5 % gelatin at different pHs. The main figure shows the SPR spectrum of the nanoparticles formed at pH 4 (A), pH 6 (B) and pH 9 (C). Inset of each plot shows the size distribution obtained after one month (●) and sixth month (○).



SFig. 5 Figure depicting stability of Au- nanoparticles formed in presence of 10 % FBS. The graph shows the intensity distribution of Au nanoparticles formed at pH 4 (A), pH 6 (B) and pH 9 (C). The line (a) corresponds to the scattering due to 10% FBS, while line (b) and (c) corresponds to the scattering due to Au nanoparticles in absence and presence of 10 % FBS, respectively.

Supplementary Tables

Table S1 Effects of gelatin concentration, pH of reaction mixture and ascorbic acid (AA) on the morphology of gold nanoparticles.

Gelatin Concentration	pH of reaction mixture	Ascorbic acid (AA) 10 mM	Morphology of nanoparticles	SPR (nm)
0.5%	4	Present	Star	760
		Absent	Not formed	-
	6	Present	Spherical	530
		Absent	Triangular	530, 1086
	9	Present	Spherical	530
		Absent	Spherical	530
1.5%	4	Present	Spherical	620
		Absent	Not formed	-
	6	Present	Spherical	530
		Absent	Spherical	530
	9	Present	Spherical	530
		Absent	Spherical	530

Table S2 Morphological characterization of star shape gold nanoparticle at different gelatin concentration.

Gelatin concentration	Ferret radius (nm)	Core size (nm)	Branch length (nm)	Radius of curvature (nm)
0.5%	85.4±3	50.4±5.3	8.9±0.8	5.2±1.0
0.6%	92.4±4.5	55.8±6.6	8.3±1.1	5.0±0.7
1%	62.8±2.5	43.5±5.7	4.3±0.3	4.1±0.6
1.5%	54.7±3.1	52.2±8.1	1.1±0.1	-

Table S3. Intensity average, volume average and number average of different shapes of Au-nanoparticles formed.

Shape of gold nanoparticle	Intensity average	Volume Average	Number average
Star	106.0 ± 47.4	49.7±21.5	20.8±8.2
Triangle	71.0±30.9	37.5±12.7	14.1±5.8
Spherical	76.5±27.4	31.3±18.2	18.5±10.4