Controlled synthesis of functional Ag, Ag-Au/Au-Ag nanoparticles and their Prussian blue nanocomposites for bioanalytical applications

Prem. C. Pandey, Richa. Singh and Yashashwa Pandey,

Department of Chemistry, Indian Institute of Technology (BHU), Varanasi-221005, UP, India. E-mail: pcpandey.apc@iitbhu.ac.in



Figure S1. Formation of AgNPs as a function of; (A) 3-APTMS concentrations (Table S1A, Sr. no. 1 to 10) and (B) Cyclohexanone concentrations (Table S1B, Sr. no. 1 to 10): keeping constant concentrations of cyclohexanone/3-APTMS (1.9 M/0.5 M) and 0.01 M AgNO₃.

Table S1 (A)

Characteristics of different Silver nanoparticles (AgNPs) made from Cyclohexanone as a function of 3-APTMS concentration.

Sr.	AgNO ₃	3-APTMS	Cyclohexanone	AgNPs formation	Extent of
no.	(M)	(M)	(M)		formation
1	0.01	0.1x10 ⁻³	1.9	White	-
2	0.01	0.001	1.9	White	-
3	0.01	0.005	1.9	White	-
4	0.01	0.01	1.9	White	-
5	0.01	0.05	1.9	White	-
6	0.01	0.1	1.9	White	-
7	0.01	0.25	1.9	Light Yellow(AgNP ₁)	++
8	0.01	0.5	1.9	$Yellow(AgNP_2)$	++++
9	0.01	1	1.9	Yellow	++++
10	0.01	2	1.9	Yellow	++++

"-" sign represents that the AgNPs are not formed whereas number of "+" sign denotes the relative rate of AgNPs formation.

S. no.	AgNO ₃	3-APTMS	Cyclohexanone	AgNPs formation	Extent of
	(M)	(M)	(M)		formation
1	0.01	0.5	0.3	White	-
2	0.01	0.5	0.6	White	-
3	0.01	0.5	0.9	Light Yellow	+
4	0.01	0.5	1.4	Light Yellow	++
5	0.01	0.5	1.9	Dark Yellow	++++
6	0.01	0.5	2.4	Light Yellow	+++
7	0.01	0.5	2.8	Light Yellow	+++
8	0.01	0.5	3.2	Light Yellow	+++
9	0.01	0.5	3.5	Light Yellow	+++
10	0.01	0.5	3.8	Light Yellow	+++

Characteristics of different Silver nanoparticles (AgNPs) as a function of Cyclohexanone concentration.

"-" sign represents that the AgNPs are not formed whereas number of "+" sign denotes the relative rate of AgNPs formation.



Figure S1. Formation of AgNPs as a function of: (C) 3-APTMS concentrations (Table S1C, Sr. no. a to j) keeping constant concentrations of Formaldehyde (0.8 M) and 0.01 M AgNO₃.

Sr. no.	AgNO ₃ (M)	3-APTMS (M)	Formaldehyde (M)	AgNPs formation	Extent of formation
а	0.01	0.1x10 ⁻³	0.8	White	-
b	0.01	0.001	0.8	White	-
с	0.01	0.005	0.8	White	-
d	0.01	0.01	0.8	White	-
e	0.01	0.05	0.8	Grey	-
f	0.01	0.1	0.8	Dark Grey	-
g	0.01	0.25	0.8	Light Yellow	+++
h	0.01	0.5	0.8	Yellow	+++
i	0.01	1	0.8	Yellow	++++
j	0.01	2	0.8	Dark Yellow	++++

Table S1 (C) Characteristics of different Silver nanoparticles (AgNPs) made from Formaldehyde as a function of 3-APTMS concentration.

"-" sign represents that the AgNPs are not formed whereas number of "+" sign denotes the relative rate of AgNPs formation.



Figure S1 (D) Effect of Formaldehyde concentrations on the formation of AgNPs [(a) 0.4 M, (b) 0.8 M and (c) 1.2 M] keeping constant concentration of 3-APTMS (0.5 M).

Supporting Information S2.

Cyclohexanone in the prevailing medium undergoes keto– enol tautomerism. Enolate ion acts as an electron donor to 3-APTMS capped Ag^+ ion, which in turn acts as a Lewis acid, leading to the formation of AgNPs along with organic-inorganic hybrid (Scheme-1) and has been confirmed by FTIR spectroscopy. The broad band between 3800 and 2800 cm⁻¹ is related to the overlap of O-H vibration modes with the organic modes. The IR peaks at 1090-1120 cm⁻¹ due to the vibrations of the C-Si-O group. A series of bands at around 2820-2940 cm⁻¹ due to the vibrations of methylene -(CH₂)₃- and the peaks at about 1220-1275 cm⁻¹ are due to the vibrations of Si-CH₃.

