Electronic Supplementary Material (ESI) for RSC Advances

Supplementary information for

A Growth Kinetic Study of Ultrafine Monodisperse Silver Nanoparticles

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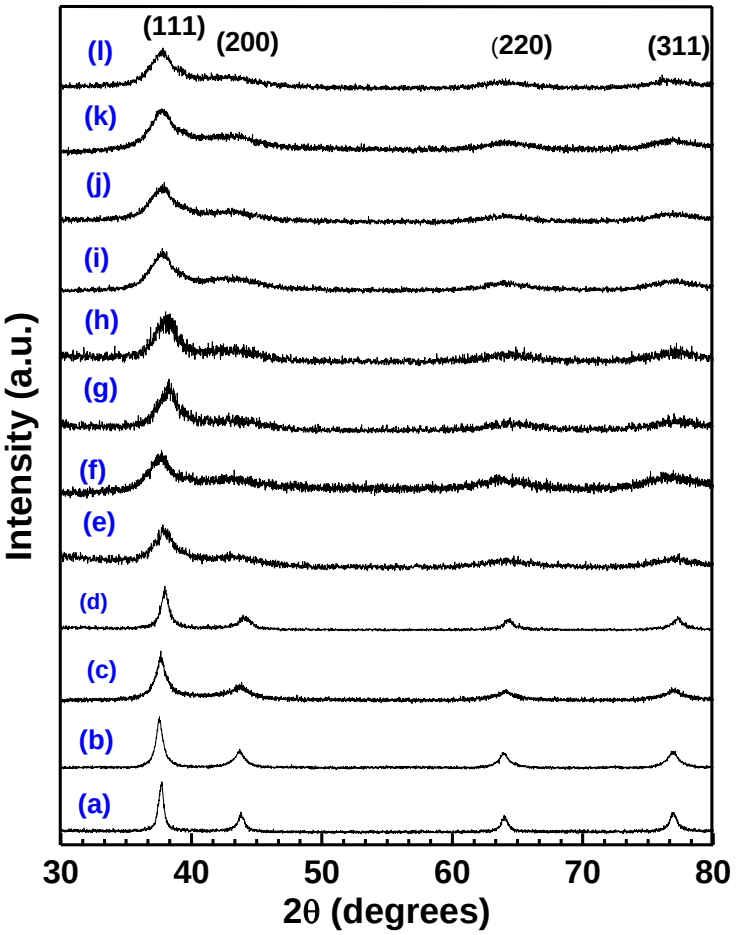

Fig. S-1a XRD pattern of as-synthesized silver nanostructures prepared at different oleylamine concentration. (a) 1.5 mM, (b) 3 mM, (c) 4.5 mM, (d) 6 mM, (e) 9 mM, (f) 12 mM, (g) 15 mM, (h) 18 mM, (i) 21 mM, (j) 24 mM, (k) 27 mM, (l) 30 mM. Samples corresponding to 1.5 mM – 4.5 mM oleylamine are the undispersed residues obtained during precipitation-redispersion as no dispersed particles could be extracted because of heavy clustering. Each diffraction pattern shows well resolved four diffraction peaks corresponding to the standard FCC structure of Ag (PDF card No. 040783). The broadening of diffraction peaks increases with oleylamine concentration till 12 mM and is constant above this.

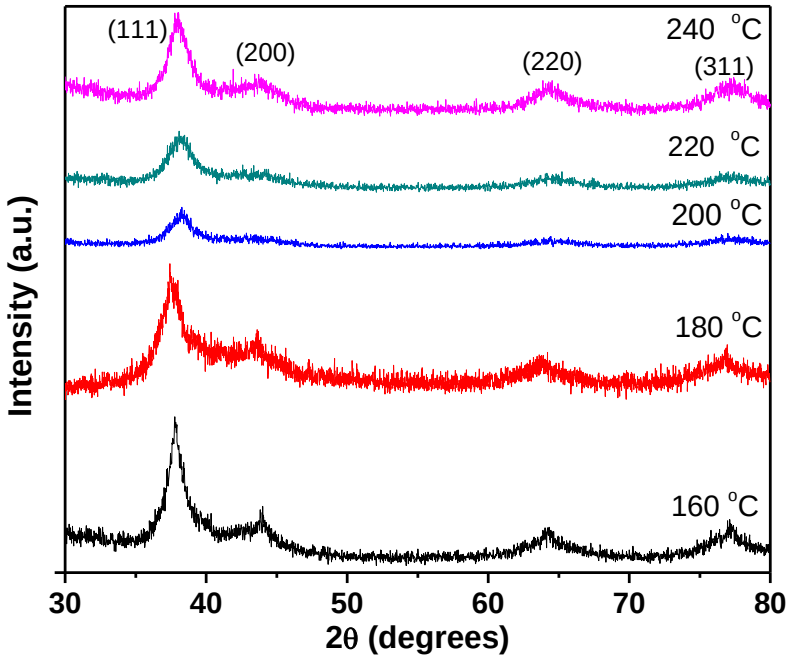

Fig. S-1b XRD pattern of as-synthesized silver nanostructures at different nucleation temperature.

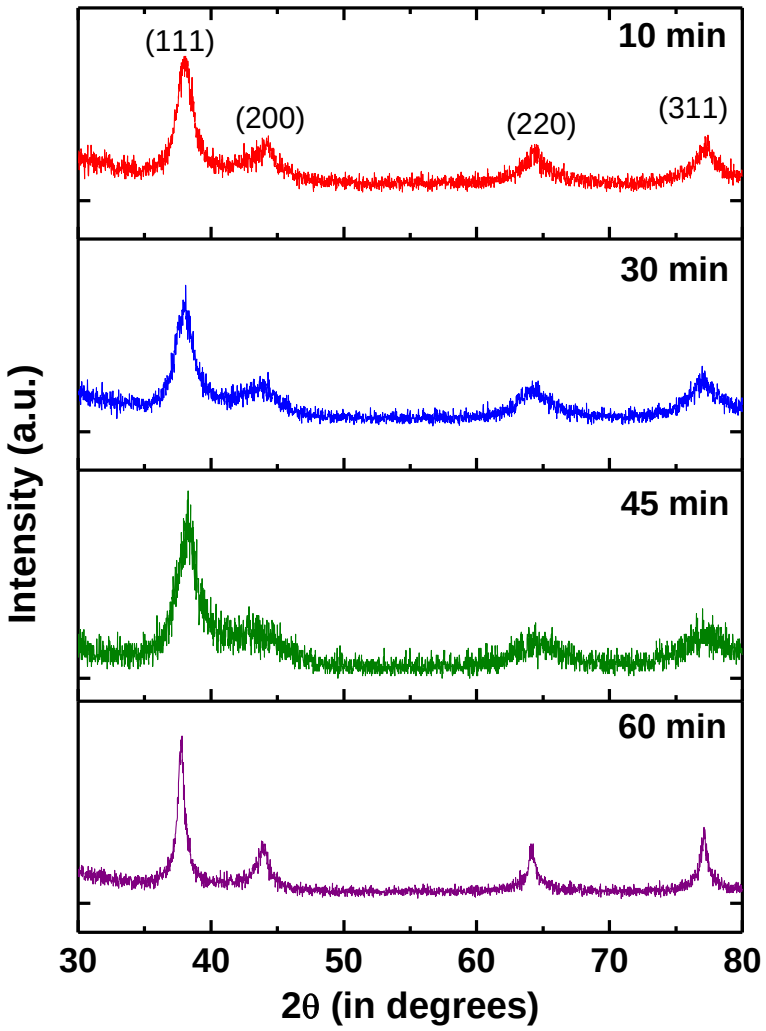

Fig. S-1c XRD pattern of as-synthesized silver nanostructures at different nucleation time.

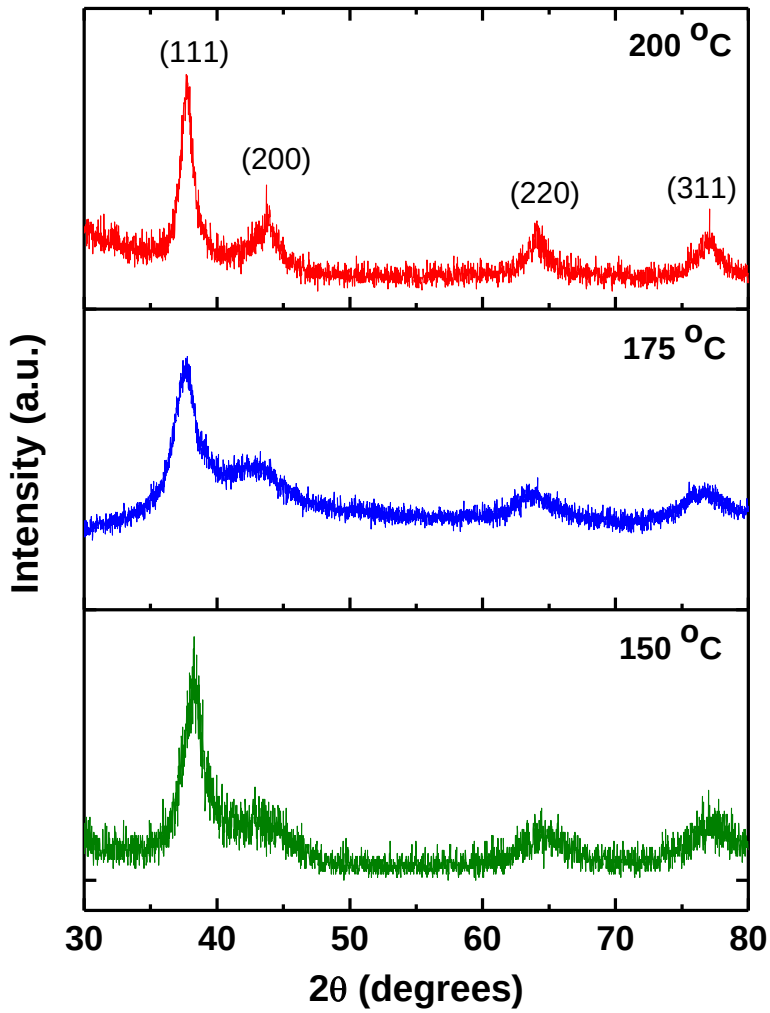

Fig. S-1d XRD pattern of as-synthesized silver nanostructures at different growth temperature.

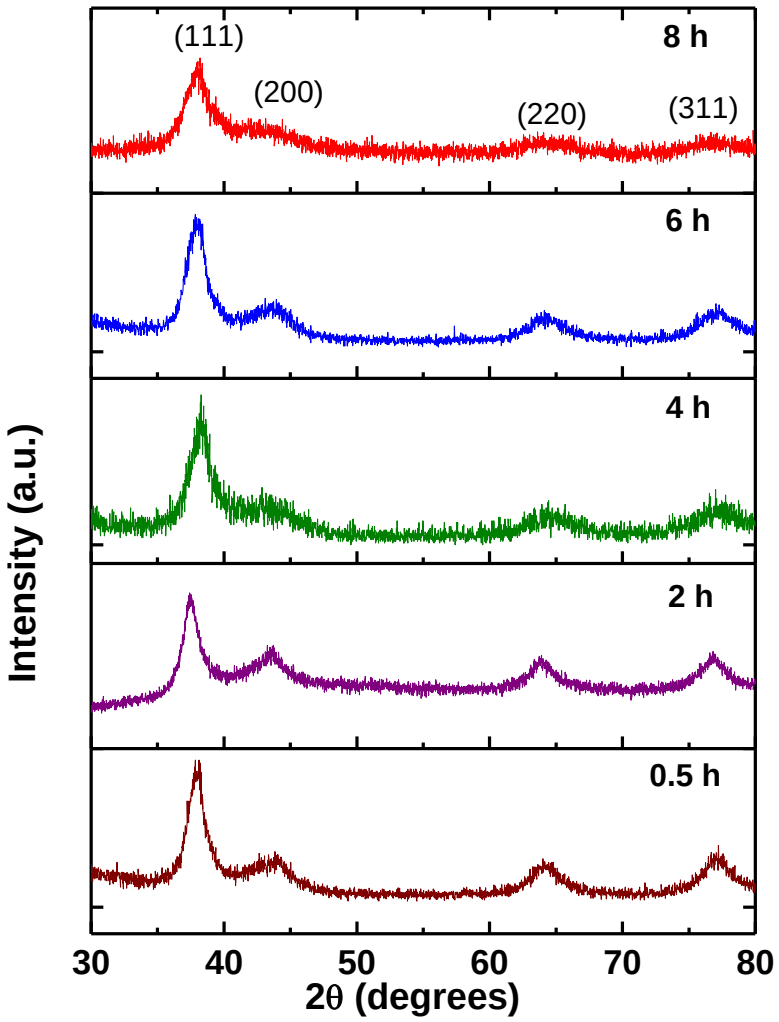

Fig. S-1e XRD patterns of silver nanoparticles at different growth time.

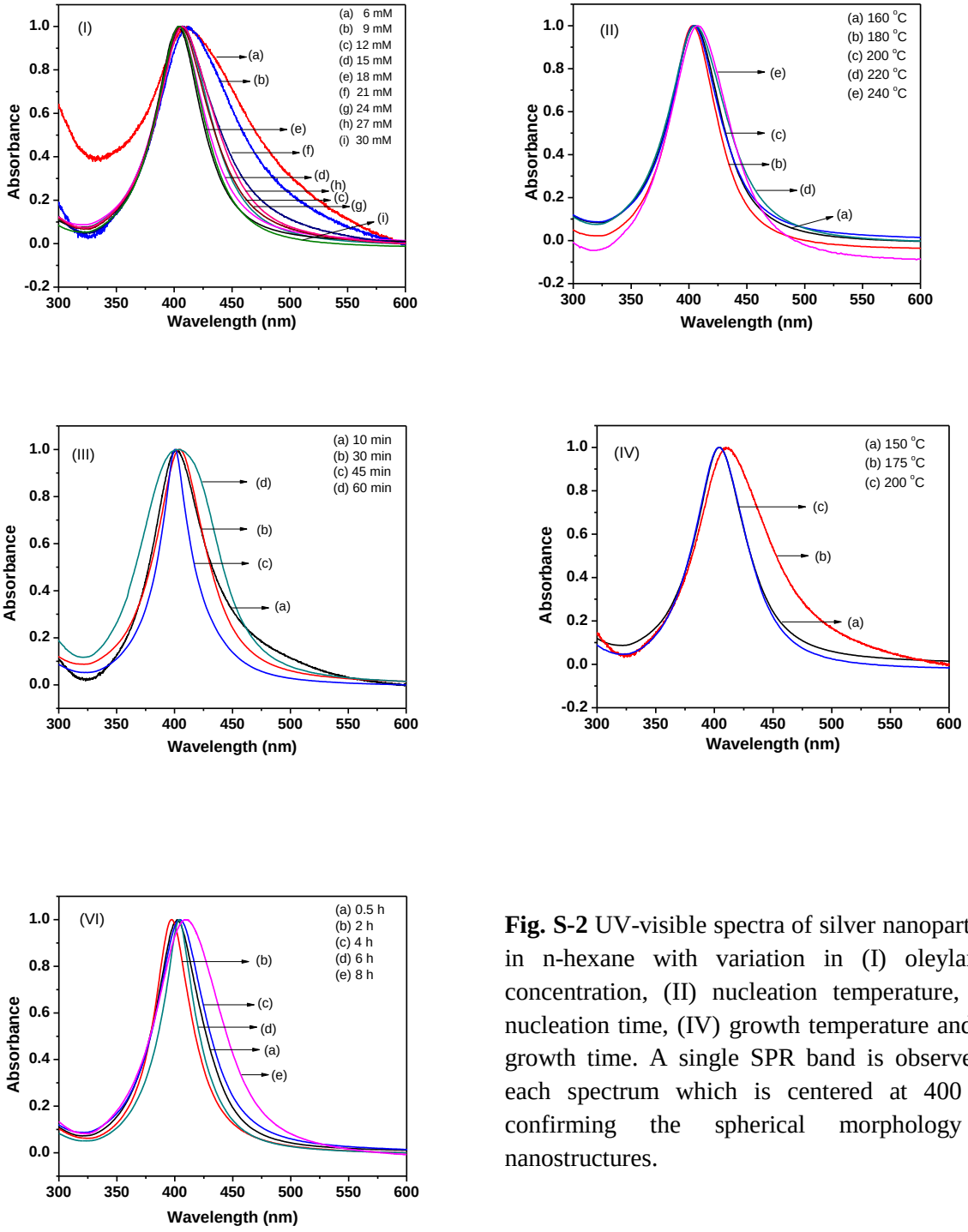

Fig. S-2 UV-visible spectra of silver nanoparticles in n-hexane with variation in (I) oleylamine concentration, (II) nucleation temperature, (III) nucleation time, (IV) growth temperature and (V) growth time. A single SPR band is observed in each spectrum which is centered at 400 nm, confirming the spherical morphology of nanostructures.

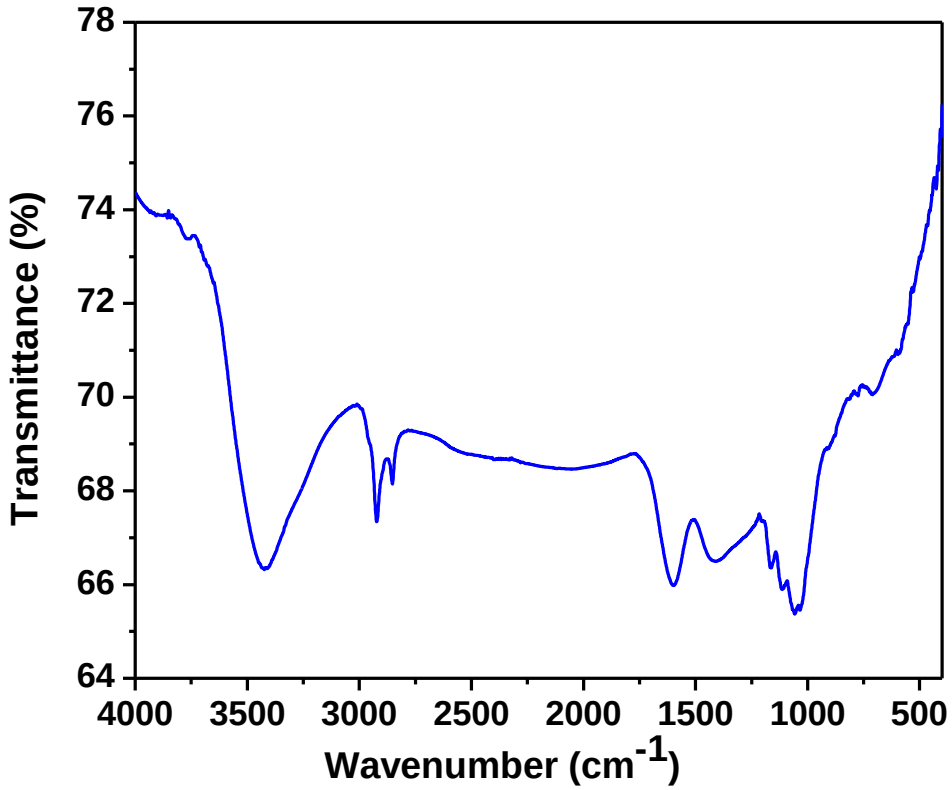

Fig. S-3 Representative FTIR spectra of oleylamine capped silver nanoparticles. To understand the interaction of nanoparticles with the surfactant, FTIR spectroscopy was employed. The bands at 2850 cm^{-1} and 2915 cm^{-1} originate from the symmetric and asymmetric stretching vibrations of C-H bonds of oleylamine. The broad absorption band centered at 3432 cm^{-1} is attributed to the N-H stretching vibrations. An additional band appeared at 1591 cm^{-1} is due to the asymmetric stretching of the Ag-N bond, suggesting that $–NH_2$ group of oleylamine coordinates with the Ag on the surface of the nanoparticles.

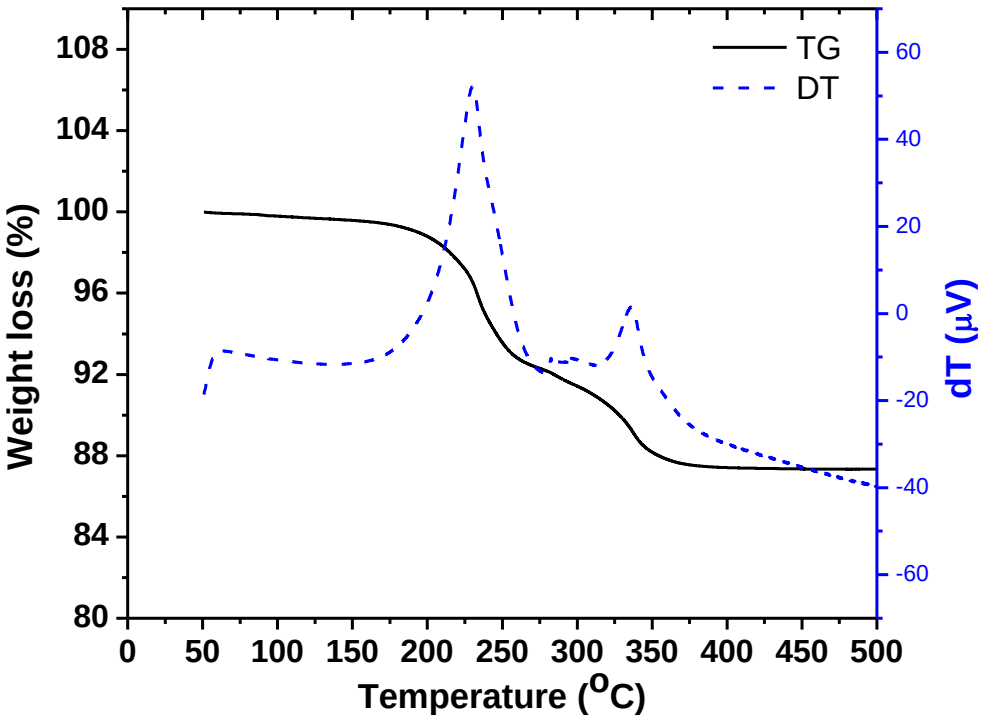

Fig. S-4 TGA/DTA curves for as-synthesized silver nanoparticles at 24 mM oleylamine concentration. 13 % weight loss is observed in a two-step process corresponding to the evaporation of oleylamine from the sample. This weight loss corresponds to the monolayer coating of oleylamine on the silver nanoparticles.

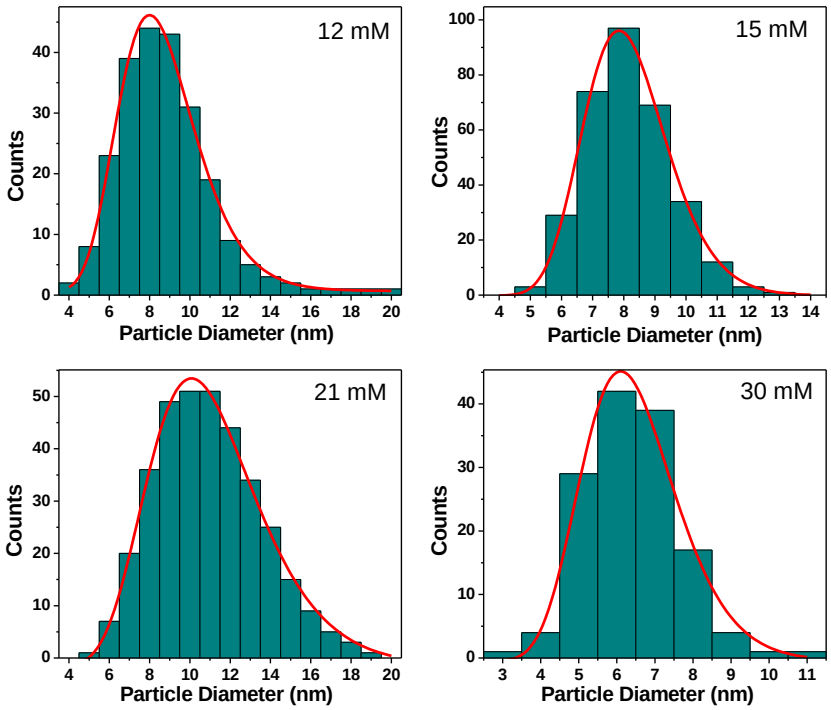

Fig. S-5 Size distribution histograms of silver nanoparticles prepared with different concentration of oleylamine. Each histogram is fitted with lognormal size distribution function.

The distribution of particle size generally follows the log-normal distribution function given as,

$$P(D) = (1/ D\sigma(2\pi)^{1/2}) \exp [- (\ln (D/D_o))^2/ 2\sigma^2]$$

where, σ is the standard deviation, *D* the particle diameter and ln D_o a mean of ln *D*.[1]

Reference

1. K. Parekh, R. V. Upadhyay, R. V. Mehta, Bull. Mater. Sci. **2000**, 23, 91–95.