

Silver nanoparticles summary report

Potential application:

Anti-bacterial agents to be incorporated into hygienic surfaces, wound treatments and medicines.

Preparation method:

Seed production:

1. 2 cm^3 of 0.001 M AgNO_3 was added to 2 cm^3 of poly vinyl acetate (PVA) (1% w/v) and mixed well.
2. While stirring constantly, 2 cm^3 of 0.001 M NaBH_4 was added drop wise to this solution.
3. The resulting solution was a golden yellow.

Fabrication of coloured colloids:

1. 1 cm^3 of the seed solution, 3 cm^3 0.1 M tri-sodium citrate (TSC) and 5 cm^3 $0.1\text{ M N}_2\text{H}_4$ was added to 1 cm^3 PVA (1% w/v) making sure to stir well.
2. Coloured colloids were produced by adding 0.001 M AgNO_3 while continuing stirring of this 'growth mixture'.

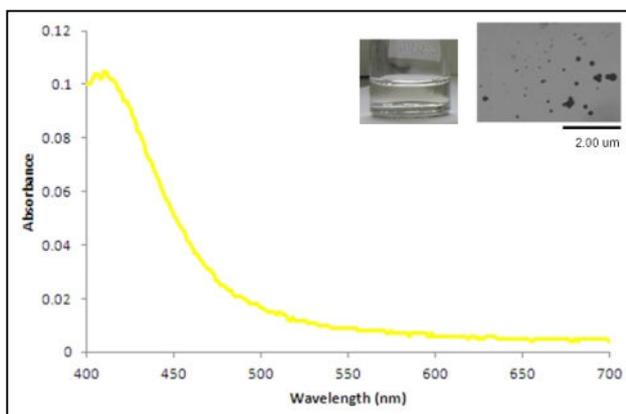
Results:

Six colloid solutions were prepared: yellow, orange, red, purple, blue and green.

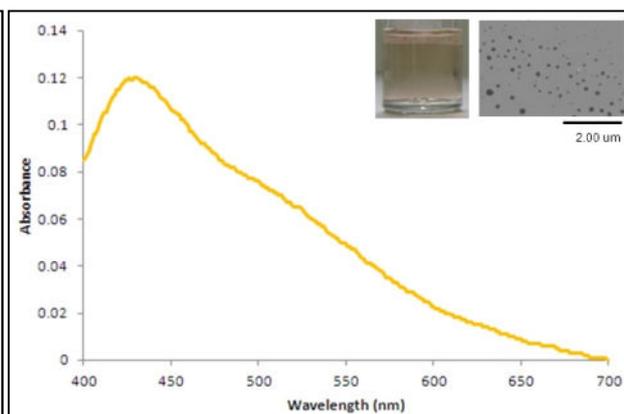


Silver nanoparticle colloid solutions

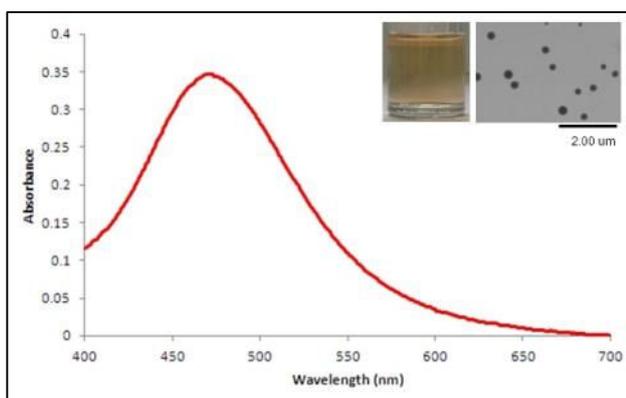
UV-vis spectroscopic analysis was carried out on each solution, and dynamic light scattering and transmission electron microscopy were also performed to determine size of particles in the colloid solution.



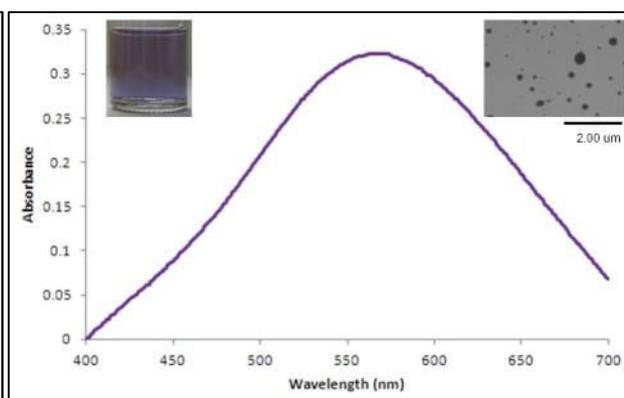
Analytical results for yellow colloid



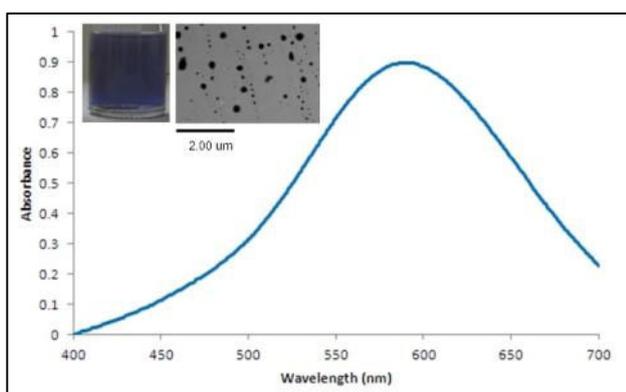
Analytical results for orange colloid



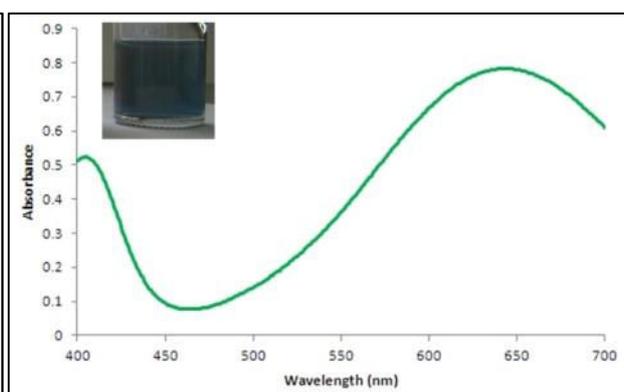
Analytical results for red colloid



Analytical results for yellow colloid

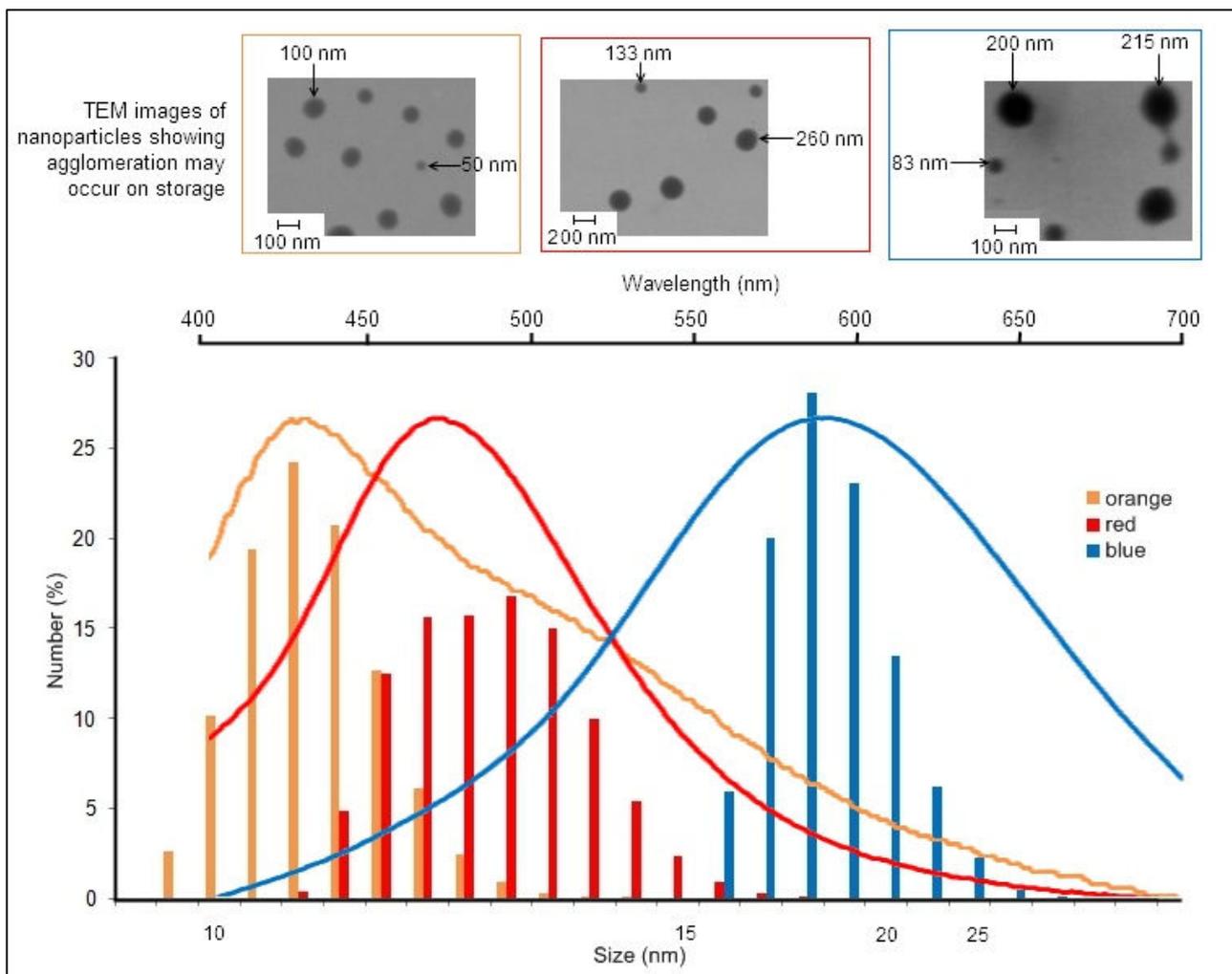


Analytical results for blue colloid



Analytical results for green colloid

It is clear that agglomeration has occurred within the colloid solutions upon storage as the particle sizes are larger than expected. Nonetheless, a clear trend can be seen correlating increase in size and the visible absorbance maximum. Therefore, visible spectroscopy can be used as a simple indication of relative particle size distribution in solutions. For example, the green solution contains a mixture of yellow and green colloid solutions as can be seen from the UV, so it can be predicted that it contains a mixture of both these small and large nanoparticles. This theory is supported by comparison with results from dynamic light scattering sizing of particles. As can be seen below, shifts in sample wavelengths correlate well with changes in particle size.



Relationship between colloid colour and size of nanoparticles