Gold nanoparticles summary report

Potential application:

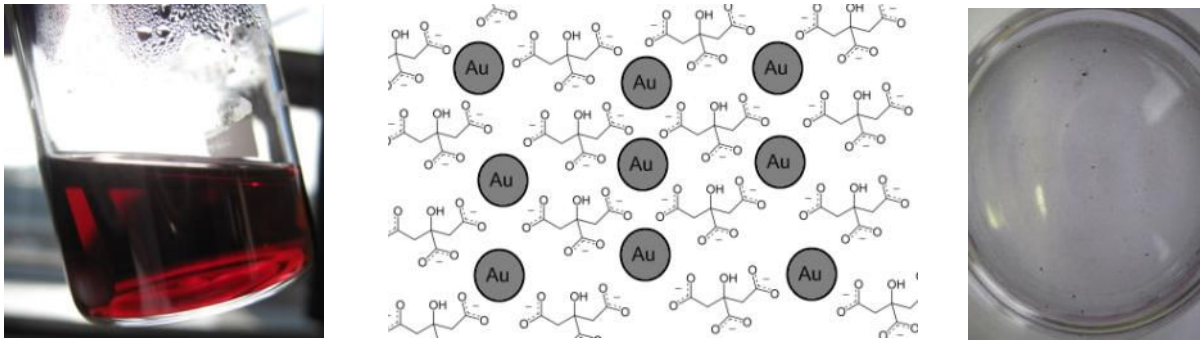
Biomarker for diagnostic medicinal use.

Preparation method:

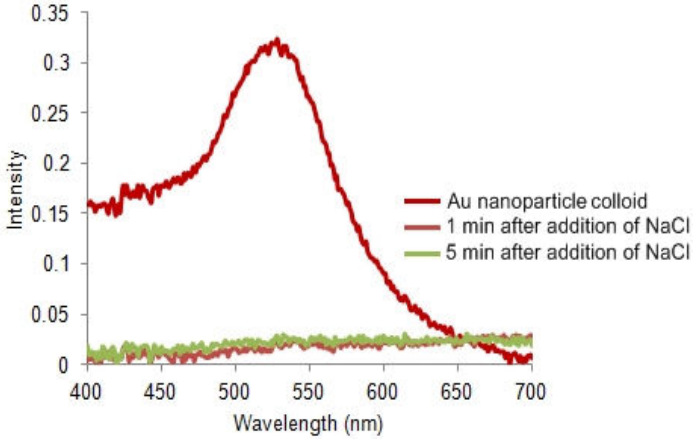
1. Prepare stock solutions of 1.0 mM $HAuCl_4$ and 38.8 mM $Na_3C_6H_5O_7$ (tri-sodium citrate) in distilled water.
2. Heat 20 cm^3 of 1.0 mM $HAuC_{l4}$ to boiling while stirring with the magnetic stir bar.
3. As the solution begins to boil, add 2 cm^3 of 38.8 mM $Na_3C_6H_5O_7$, continuing to boil and stir the solution until it is a deep red color (about 10 min). Add distilled water as needed to keep the total solution volume constant at 22 cm^3.
4. When the solution is a deep red colour, turn off the hot plate and stirrer. Cool the solution to room temperature.
5. To test the effect of electrostatic forces, a few drops of 1 M NaCl may be added to the solution. Stir for approximately 10 minutes.

Results:

A red solution is formed containing the gold nanoparticle colloid. The colloid system is stabilised by citrate ions which prevent the gold particles from agglomerating and falling out of solution. Addition of an electrolyte such as NaCl can disrupt this system and destroy the colloid.



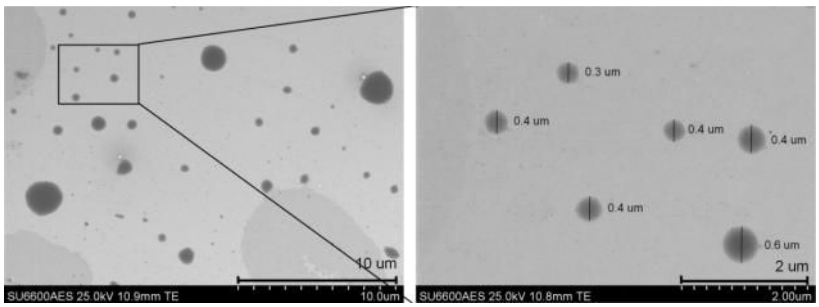
A) Gold nanoparticle colloid B) stabilising effect of citrate ions which prevent agglomeration C) aggregated particles which have fallen out of solution after addition of NaCl



Visible absorption of the colloid solution changes upon addition of the NaCl. This shows that within 1 minute there is already significant loss of the nanoparticles from solution.

Visible spectrum of gold colloid solutions

Transmission electron microscopy (TEM) was used to estimate the size of the gold nanoparticles. The large range of sizes suggests that the particles have begun to agglomerate, and may not be forming a stable colloid.



TEM images of the gold nanoparticles