Lipid-Coated Core-Shell Noble Metal Nanoparticles

Ana Alfaro, Dr. Brian D. Gilbert
Linfield College Department of Chemistry
McMinnville, Oregon 97128

Introduction

Applications of gold nanoparticles are on the forefront of research in many areas, including environmental, industrial, and biomedical sciences. Altering the surface treatment of spherical gold nanoparticle cores, particularly those smaller than 100 nm, can influence their potential use in a number of ways.
Surface-enhanced Raman spectroscopy (SERS) is important due to its ability to allow deep and high resolution volumetric imaging of biological tissues. By using a 532 nm laser, the plasmon resonance of silver is more intense than gold, for that reason the Au-NP's are coated with silver (Fig. 1)

As an effort to create a nanoparticle therapeutic delivery system, yeast cells are used for the reason that they are eukaryotic cells like human cells and have the advantage of growing rapidly (Fig. 4).

The strand of yeast grown was BY4743 and grown in a yeast extract, peptone, dextrose medium (YPD).

Materials and Methods

Au-NP synthesis: All glassware was cleaned with Aqua Regia (3:1, conc.HCL:conc.HNO_3) and rinsed with deionized water. Chloroauric acid (1.5 mL, 0.015 mM) and deionized water (50 mL) were refluxed until boiling. Sodium citrate (1%, 1.0 mL) was added to the solution and was refluxed for an additional 30 minutes until color change indicated production of colloidal nanoparticle solutions with a range of particle sizes.

Silver coating: Au seeds (5 mL) were diluted in deionized water (93.65 mL) and heated until ebullition. Once boiling, silver nitrate (450 **µ**L, 30 mM) is added and immediately after, trisodium citrate (1mL, 170mM).

Yeast cultivation: In a sterile environment YPD medium(1.5 mL) we placed in a vile. Yeast culture was mixed into the medium. Yeast cells were incubated and shaken at a temperature of 30° C for 24 hrs. The growing period for yeast is about three days (Fig. 4).

Spectroscopy analysis: Nanoparticle solutions were characterized using Hitachi UV-vis spectrophotometer and NanoSight LM10HS particle sizer, and Raman excitation at 532 nm.

Results

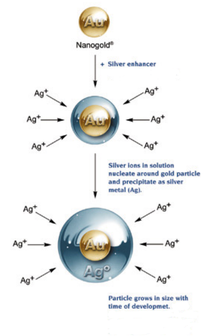

Figure 1: Gold core nanoparticles coated with silver.[1]

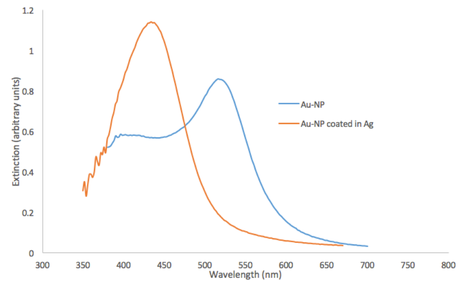

Figure 2: UV-vis extinction spectra of gold seed nanoparticles and silver coated Au nanoparticles

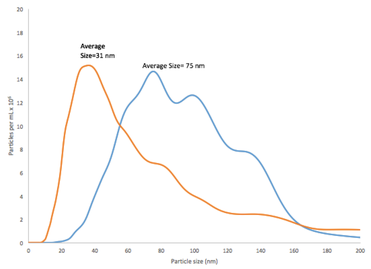

Figure 3: Characterization of Silver coated gold nanoparticle cores and Au seeds using NanoSight.

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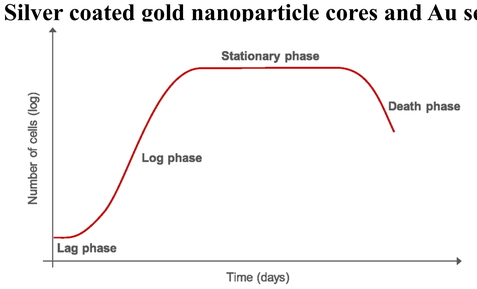

Figure 4: Growth curve of yeast cells[4]

Conclusions

Small increases in diameter suggest successful coating of Au-NP with silver. Cultivation of yeast cells were successful and observed through calculations of optical density using UV-Vis. Tests for localization of nanoparticles in yeast cells were inconclusive as there was no peak at 400 nm resembling that of silver.

Continuing Research:

-Breaking down yeast cell wall with lyticase to improve uptake.

- Attaching specific antibodies to nanoparticles, making them more attractive to yeast cells.

References

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