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DMSO and temperature contribute to synthesis of sliver nanoparticles by the bacterium *Shewanella oneidensis*

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Abstract

Nanomaterials (NM) are widely used in commercial applications such as optical devices, mechanics, magnetics, catalysis, energy science, and drug delivery. Therefore, varieties of methods to synthesis silver nanoparticles have been developed in past decades. *Shewanella oneidensis* is Gram-negative bacterium which can reduce sliver cation to silver nanoparticles. This research utilized temperature and the co-solvent DMSO to affect the size and morphology of biogenically synthesized silver NMs. The result of UV-vis spectrometer demonstrate that the temperature and DMSO has significant influence on the production of silver NM.

Introduction/Motivation

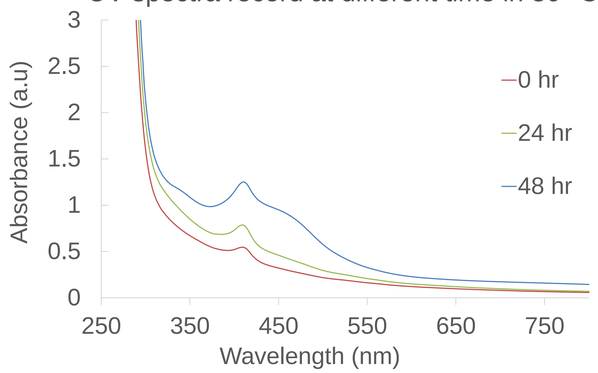
- Most methods to synthesis silver NM are expensive or environmentally unfriendly.
- Biogenic NMs are typically hydrophilic and have increased biocompatibility.
- Co-solvent DMSO can transfer material in cells without destroying cell membrane.

Methodology

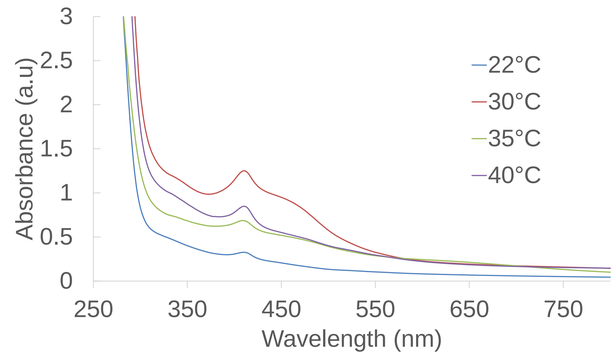
- Culture *S. oneidensis* in LB medium for 24 hr
- Suspended cells in two reaction groups and react for 48hr ($AgNO_3$ only and $AgNO_3$/DMSO).
- Centrifuge and filter the reaction solution.
- Get the sliver nanoparticles in supernatant.
- Monitor the reaction process by UV-vis spectrometer at 410 nm at 0 hr, 24hr, 48hr.

Results

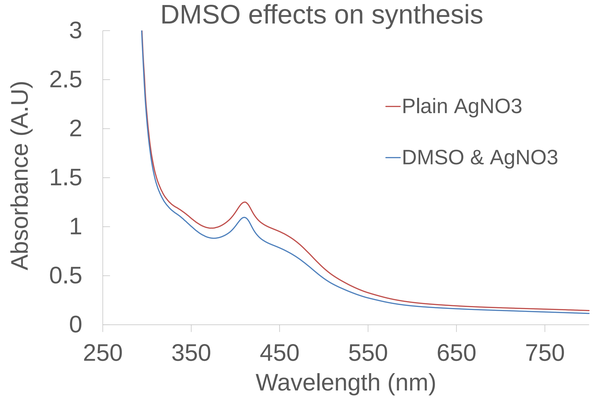
UV spectra record at different time in 30 °C



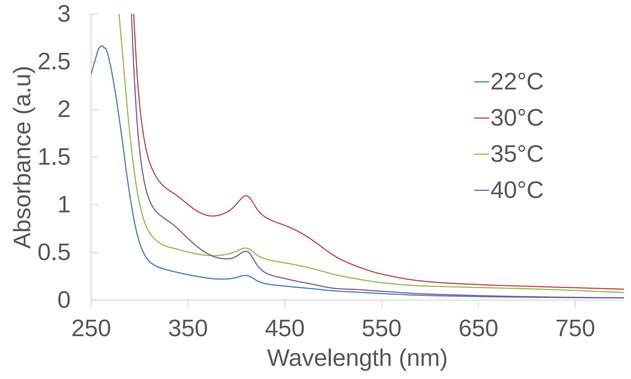
Plain silver nitrate reaction at 48hr



DMSO effects on synthesis



DMSO&silver nitrate at 48 hr



Conclusions

- Absorbance at 410nm indicate this is the silver NMs absorbance.
- Based on the UV spectra, the silver nanoparticle diameter is estimated at 20-100 nm.
- Production rate increases in 2nd 24 hrs.
- DMSO reduced the NMs production rate
- 30°C is the optimum reaction temp
- At lower temperature, the production rate decreases more quickly than at increasing temperatures.
- NMs synthesis maintained from 22 to 40°C

Future work

- Use TEM, X-ray, FTIR to characterize the properties of silver nanoparticles.
- Investigate different DMSO concentration effects on NMs synthesis.
- Investigate bio-toxicity of silver NMs.

Acknowledgments

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