Generation of Silver Nanoparticle Pharmacokinetic Profiles in a Lung Model

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Rationale

- Silver nanoparticles (AgNPs) exhibit unique properties due to their size and are becoming increasingly prevalent in consumer and industrial settings[1]
- AgNPs are known to induce cytotoxicity within in vitro and in vivo environments[2]
- Correlations have been found between bioresponses and concentration of internalized NPs[3]
- The goal was to develop pharmacokinetic profiles for experimental AgNPs within a lung (A549) cell model

Methodology

- *Cell Model:* Human alveolar cells (A549)
- *10 nm AgNPs:* citrate and PVP coatings
- *Cytotoxicity:* Exposed A549s to AgNPs and analyzed viability using MTS assay
- *Pharmacokinetics*: Exposure of A549s to AgNPs and quantified delivered dose via absorbance analysis

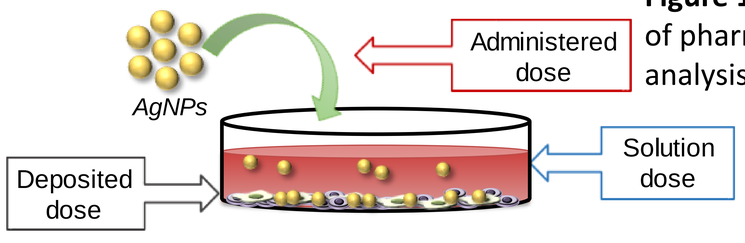

Figure 1: Explanation of pharmacokinetic analysis of AgNPs

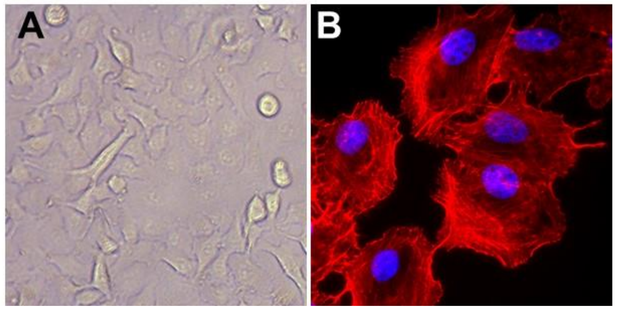

Figure 2: Images of A549 cells via (A) light and (B) fluorescence microscopy

Results

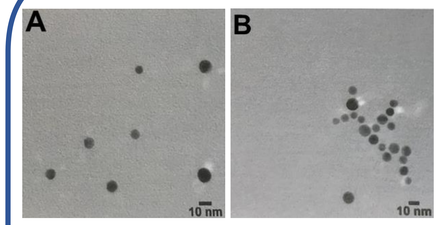

Figure 3: TEM images of (A) citrate and (B) PVP AgNPs

Table 1: AgNP Characterization

	Primary Size (nm)	Agglomerate Size (nm)		Zeta Potential (mV)	
		Water	*Media*	*Water*	*Media*
Citrate	9.3 ± 1.8	22.9 ± 2.3	47.0 ± 2.9	-38.6 ± 1.4	-9.4 ± 0.7
PVP	10.6 ± 1.6	19.1 ± 1.5	35.3 ± 1.8	-22.1 ± 1.1	-10.2 ± 0.6

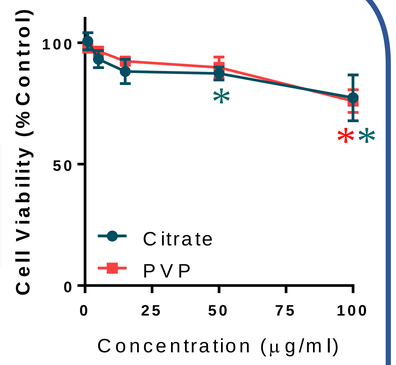

Figure 4: Toxicity analysis determined AgNP dosage for deposition experiments.

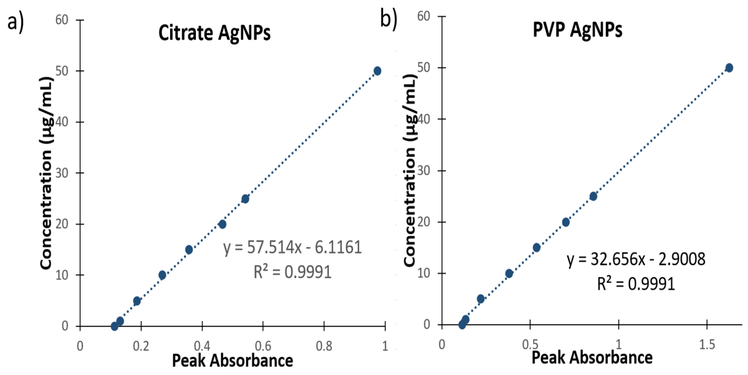

Figure 5: Calibration curves correlated AgNP dose to peak absorbance

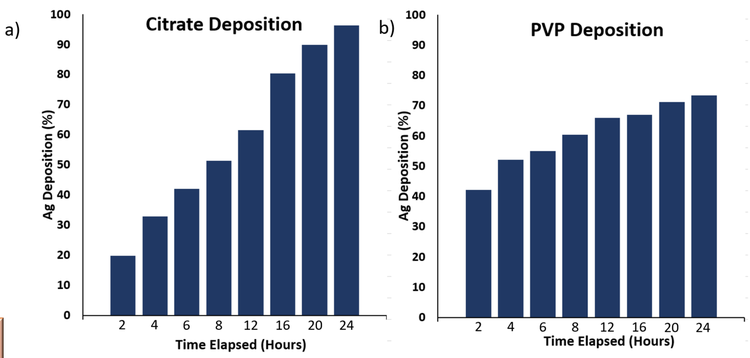

Figure 6: AgNP deposition over a range of time exposures from 2-24 hours

AgNPs interact with the A549 cells to a high degree within a static environment.

Conclusions

- Using the toxicity analysis, an AgNP dosage of 25 µg/mL was selected.
- A high degree of A549-AgNP association was determined for both experimental particle sets, with citrate coated AgNPs having a higher degree of interaction than PVP coated AgNPs.
- Future work will repeat these analyses at different nanoparticle sizes and under dynamic exposure conditions.

Acknowledgements and References

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1. V. Bastos, et al. *J Nanopart Res,* **2017,** 19, 163.
2. K.K. Comfort, et al. *ACS Nano*, **2014**, *8*, 3260.
3. J.G. Teeguareden et al. *Toxicol. Sci.,* **2007**, *95*, 300.