The fate of aerosol AuNP upon deposition into physiological fluids – Protein corona and aggregation in solution

Svensson, Christian; Messing, Maria; Lundqvist, Martin; Schollin, Alexander; Deppert, Knut; Linse, Sara; Pagels, Joakim; Rissler, Jenny; Cedervall, Tommy

2012

Link to publication

Citation for published version (APA):

Total number of authors:
9

General rights
Unless other specific re-use rights are stated the following general rights apply:
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.
• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal

Read more about Creative commons licenses: https://creativecommons.org/licenses/

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
The fate of aerosol gold nanoparticles upon deposition into physiological fluids

Christian Svensson1*, Maria E Messing2, Martin Lundqvist3,4, Alexander Scholin3, Knut Deppert2, Sara Linse3, Joakim Pagels1, Jenny Rissler1, and Tommy Cedervall3

1Ergonomics and Aerosol Technology, Lund University, Lund, Sweden
2Solid State Physics, Lund University, Lund, Sweden
3Biochemistry and Molecular Biology, Lund University, Sweden
4High School of Klippan, Sweden
*Christian.Svensson@design.lth.se

During the last decade traditional forms of toxicological methodology has been discussed with regards to nanoparticle toxicology. Deposition in the respiratory system represents one of the major intake routes for nanoparticles. Hence in order to move towards a more relevant and realistic toxicological situation it has been proposed that particles should be delivered from aerosol phase onto physiological media and cells (1,2). In this study we show that it is possible to deposit engineered nanoparticles from an aerosol phase into various physiological solutions. The gold nanoparticles (AuNP) were deposited in both agglomerate and spherical forms of 60 nm, classified by electrical mobility. The physiological solutions were selected based on increasing complexity with regards to the stabilizing agents, proteins and biomolecules.

Conclusion and outlook

- The major findings in this work are that AuNPs generated and deposited from gas phase into biological fluids are stabilized and dispersed in the fluids. AuNP-Protein complexes of distinct sizes are formed.
- A natural step would be to employ this complete method in a specially designed Air-Liquid Interface chamber (2) in combination with cell exposure to nanoparticles. This would further enhance the quantitative and qualitative understanding of nanoparticle toxicology.

15-16 μg/ml AUNP was selected for deposition into the physiological solutions (a,dashed line). AuNP aerosol mass characterisation was performed using an Aerosol Particle Mass Analyzer (3).

(a) Spherical AuNP size distribution. Dashed lines are deposited AuNP fractions.
(b) Agglomerate AuNP
(c) Spherical AuNP

Characterization in solution

- Hydrodynamic size - Dynamic light scattering (DLS) and Particle tracking analysis (PTA)
- Aggregation - (UV spectroscopy)
- Protein corona - (SDS-PAGE electrophoresis)

(a) AuNP-Albumin complex hydrodynamic size, measured by PTA.
(b) Intensity shift between albumin and the AuNP-Protein complex with increasing dilution ratio, measured by DLS.
(c) AuNP-Protein complex hydrodynamic size in albumin and serum solution, measured by PTA.
(d) AuNP-Protein complex hydrodynamic size in albumin and serum solution, measured by DLS.

! Dashed line represent AnNP selected for deposition (a,c,d) !