Silver nanoparticles are postulated to be released into the sewerage systems and wider environment in increasing quantities because of an increase in the number of consumer products, often labelled as antibacterial, which contain engineered silver nanoparticles. These particles are presently considered the fastest growing nanotechnology application. Silver nanoparticles have increased cytotoxic properties compared to larger silver particles and there are concerns that they could inhibit the bacteria which are involved in the breakdown and processing of biological waste in wastewater treatment facilities and be harmful to aquatic organisms.

Whether the enhanced toxicity of silver nanoparticles is due to an increased release of silver ions or it is related to additional mechanisms for toxicity is still a matter of scientific debate since there are studies supporting both theories. Furthermore, nanoparticles are highly heterogeneous in suspension and over time undergo processes such as aggregation, sedimentation, dissolution and changes in surface chemistry [1] – thus altering the dose and posing problems in standard experimental ecotoxicology model systems. Recently a modified short-term model has been suggested, which could potentially increase the accuracy of algal growth inhibition tests with silver nanoparticles [2].

However, toxic mechanisms remain to be further elucidated and the uptake mechanism of the nanoparticles in aquatic organisms on an ultrastructural level play an important part of this. Selenastrum capricornutum Printz (1913) CCAP 278/4 (Pseudokirchneriella subcapitata (Korschikov) Hindák 1990) is a microalgae which is routinely applied in eco toxicity tests. In this study P. subcapitata were exposed to silver nanoparticles. They were then fixed with formaldehyde and glutaraldehyde, post fixed with osmium tetroxide, en bloc stained with uranyl acetate and dehydrated in graded series of ethanol. A number of protocols were tested to create the best contrast for FIB SEM work and for future 3View work. Finally the Samples were embedded in Spurr’s or Durcupan resin. The samples were either sectioned by ultramicrotomy and imaged by TEM, or they were imaged by serial block face sectioning in the FIB SEM for localization of the silver nanoparticles within the organisms. Furthermore, EDS was employed to analyse the silver nanoparticles. The results of these different techniques will be presented.


Acknowledgement: The authors gratefully acknowledge funding from The Society of Electron Microscope Technology. Images were acquired at Centre For Ultra Structural Imaging, King’s College London and Center for Electron Nanoscopy, Technical University of Denmark.