The use of algal photosynthesis as a sensor of bioavailable silver from nanomaterials at complex biological interfaces

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Silver nanoparticles –AgNP- are among the most used nanomaterials in consumer products.Their applications relates to the biocidal activity of the silver ions (soluble Ag) released from nanoparticles and nanostructured surfaces. However, it is difficult to assess the Ag readily bioavailable from silver nanoparticles at biological interfaces (i.e. nanoparticles interacting with algal cells). Because the fast biological uptake of silver by cells, traditional methods for assessing dissolved –bioavailable- silver usually understimates the amount of active silver that would be delivered once in contact with living cells. This exposure scenario becomes more complex if coatings, modulating the release of dissolved silver, are involved.

The use of the algal photosynthesis as a short-term sensor of bioavailable silver may support traditional analytical methods (see Figure 1), providing a more complete picture at biological interfaces. This approach has been early developed in 2008[1], being later applied to differently coated AgNPs[2] and nanostructured surfaces[3], and finally being applied in the improvement of marketed products[4]. The use of algal photosynthesis allowed for for understanding the role of different chemicals used as coatings, and the role played by differently sized shells in the amount of bioavailable Ag.

References

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Figures

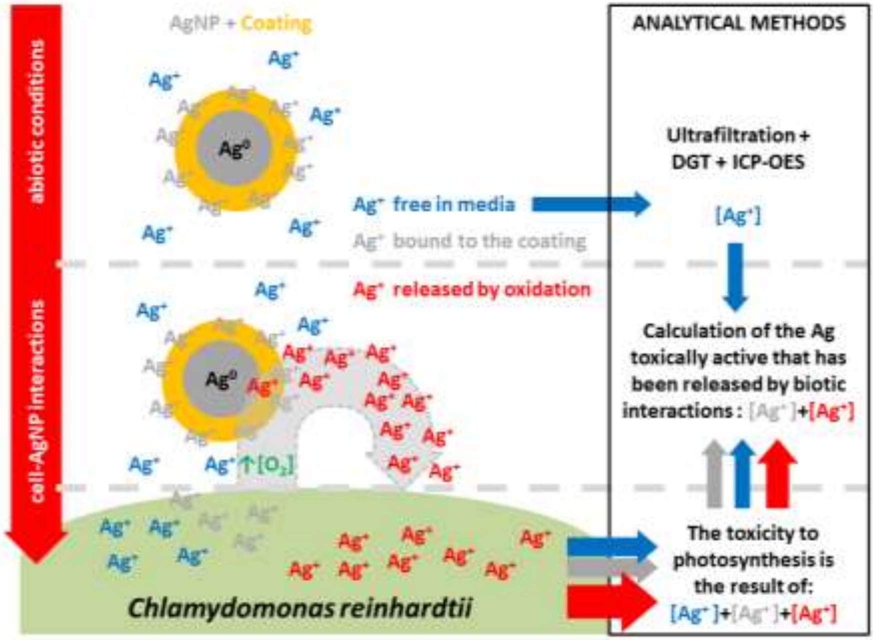

Figure 1: Conceptual model, explaining how the AgNPs measured toxicity on the photosynthesis of *C. reinhardtii* allows us to estimate the amount of ionic Ag (Ag^+) released under biotic conditions (i.e. interactions between photosynthetically active algal cells and AgNPs in suspension). Methods used under abiotic conditions understimate the amount of bioavailable Ag at the AgNP-cell interfaces. Combining traditional methods (i.e. Diffusive Gradients in Thin Films –DGT; ICP-OES, etc…) with the information provided by the photosynthesis, there is a more complete picture of the processes involved in the delivery of bioavailable Ag at the biological intefaces.