

Interactions of Ag NPs with humic substances and extracellular polymeric substances

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Manufactured nanoparticles (NPs) can interact with abiotic molecules in the environment, yielding a transformed NP, with new distinct properties. Despite the intense research being done, the gathered knowledge on their environmental interactions is still scarce. The aim of this work was to mechanistically understand the interactions between manufactured coated AgNPs, humic substances (HS) and extracellular polymeric substances (EPS). The HS was extracted from the Sorocabinha river (São Paulo, Brazil), whereas the EPS was produced from the microalgae *P. subcapitata*. 1 and 100 ppb of citrate and PEG Ag NPs (diameter of 10 nm), were dispersed in two different media (algae and daphnia media) at different pH values in absence and presence of HS (1 and 10 ppm), or EPS (1 and 5 ppm) or both. The electrostatics, dissolution, aggregation and sedimentation were thoroughly studied.

The electrophoretic mobility measurements (EPM) show a slight effect of time from 0 to 24 h. Also, the particles when dispersed in the algae medium have slight more negative EPM than in the daphnia media. The presence of the organic matter (OM) leads to more negative EPM (and more stable results) for both particles and media. This was expected since the OM is usually negative for all pH range. However, the OM effect on the NPs dissolution was only observed when in presence of the higher NPs concentration and also for the larger OM concentration; at $t=2h$ the dissolution reduced from 5 to 1 % in presence of OM, whereas at $t=196h$ the dissolution reduced from 30 to 2 %. In absence of the OM, or when in presence of the lower OM concentration, the NPs dissolution is linear with time. The aggregation and sedimentation was measured with the Turbiscan technology that allows the understanding of the mechanism behind the interactions. The raw data indicates that there is slow sedimentation and flocculation of the particles with time. This data is still being analyzed and will be discussed thoroughly during the presentation. Moreover, statistical correlations will be performed between the resulting interactions and the NPs and the colloids properties and the media composition. It can be anticipated that the interactions with abiotic components will affect the NPs fate and bioavailability, with high consequences for the toxicological studies.