Stability and dissolution of copper oxide nanoparticles in a range of biological and environmental media

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An important challenge when assessing the human and environmental safety of engineered nanoparticles (ENPs) is to ascertain whether the observed toxicity is due to the NPs directly, or mediated by the release of ions (dissolution), or a combination of both. Investigating the effect of various media on reactivity (change in size, agglomeration, surface charge etc.) and dissolution of ENPs will allow evaluation of the persistence of ENPs and the likelihood of biological impact. Dissolution [1] in particular, can significantly change the state of ENPs in the media and therefore merits a systematic study in order to (i) correctly interpret the biological response triggered by ENPs; (ii) establish the likely timescales during which there is a risk from ENPs exposure within different biological/environmental compartments and (iii) postulate the cellular uptake mechanisms NPs may undergo.

In this study, we therefore examine the aggregation and dissolution of 7 nm copper oxide (CuO) NPs in various environmental (algal growth medium, artificial fresh water with/without humic acid) and biological media (simulated body fluid, artificial lysosomal fluid, cell culture medium). Dissolution studies were performed over a period of 7 days followed by TEM inverstigations to ascertain the fate of the particles. In addition, dynamic light scattering, zeta potential and disc centrifuge sedimentation techniques were also used to study the change in size of the NPs in all the media.

We observed the media to play a contrasting and influential role in the dissolution of CuO NPs. Our research strongly suggests that biouptake pathway, toxicity mechanisms and environmental partitioning for CuO NPs is controlled by its interaction/dissolution in a given media.

[1] Misra SK *et al Science of the Total Environment,* 2012: **438**, 225