A STUDY OF ULTRA-SONICATION INSTRUMENTS AND PROCESSES FOR RE-DISPERSING NANOPARTICLE POWDERS IN LIQUID MEDIA

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Abstract

In February 2011 the Institute for Health and Consumer Protection (IHCP) inaugurated a repository of representative nanomaterials. The repository was created to help support intentional collaborative studies of nanomaterials by providing nanotechnology researchers with ready access to representative set of key technologically relevant nanostructured materials. The repository brings together the principal nanomaterials from the OECD sponsorship programme - titanium dioxide, silicon dioxide, zinc oxide, cerium dioxide, nanoclays and multi-walled carbon nanotubes as well as silver and gold colloidal dispersions. These RTM (Representative Test Materials) have been widely used in experiments and international test sessions in many EU and non-European Countries. The majority of these materials are present as solid powders and as such, may be aggregated and/or agglomerated. This complicates both their characterization and their further application in toxicological and eco-toxicological tests as many applications require re-dispersion in a liquid medium before use. Unfortunately, in most cases, the step of re-dispersion in a liquid medium cannot be achieved efficiently or reproducibly by simple mixing, stirring or vortexing alone and instead requires more energy intensive methods such as ultrasonication to achieve acceptable dispersions. This step can introduce variables whose influence on dispersion efficiency is often unknown or underestimated.In this study, a selection of powder materials from JRC nanomaterials repository were chosen and re-dispersed in MilliQ water. Samples were then treated with two ultrasonication instruments, ultrasonic bath and vial tweeter, at different timings. Dispersions were verified through CLS (centrifuge liquid sedimentation) and DLS (dynamic light scattering) techniques, which show the size distribution of the samples treated with the different methods. Data obtained confirmed that results in terms of size distribution can vary even drastically depending on the sonication tool utilized and timing. Samples were finally evaluated in relation to their behaviour when exposed to in-vitro cell culture media and results evaluated with the scope of identifying possible correlations between sonication procedure, the resulting dispersion and eventual results of cell toxicity assays.

Keywords: representative nanomaterials, solid powders, ultrasonication processes, ultrasonication tools

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