Quantifying Particle Number Concentration and Characterisation of Nanoparticles by Multimethod Approach

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Abstract

Nanoscience and nanotechnology are concerned with the nanoscale, usually defined between 1-100 nm (ASTM 2006). According to the EU SCENIHR [1], certain physico-chemical properties of relevant nanoparticles (NPs) are anticipated to have major impacts on their behaviour in the environment. Therefore, it is of paramount importance in this project to understand and quantify the environmental effects of nanomaterial, which requires understanding of their physico-chemical properties. Of particular relevance to this project are the appropriate metrics for characterising the concentration of nanoparticle (NP) as it is recognised that the mass concentration used for conventional chemicals may be inappropriate [2-4]. Therefore, it is requisite to identify the most appropriate metrics and methodologies for the measurement and characterisation of NPs. The appropriate metrics to use in NP studies is an important policy issue of the 19 research objectives produced by the UK government (DEFRA) [5].

To analyse the number concentration with different techniques, the NPs were synthesised in-house. The number concentration measurement was carried out with different dilutions. By the analysis of different sample preparation method, the ultracentrifugation method of sample preparation having the substrate treated with the poly-l-lysine was identified as ultimate method to obtain the uniform distribution of NPs on the substrate. This new approach resulted with the good agreement between the techniques for the determination of the particle number measurement.

Keywords: nanoparticles (NPs), nanomaterial (NM), atomic force microscopy (AFM) and transmission electron microscopy (TEM), gold nanoparticle (AuNPs), poly-l-lysine (PLL), dynamic light scattering (DLS) and nanoparticle tracking analysis (NTA).

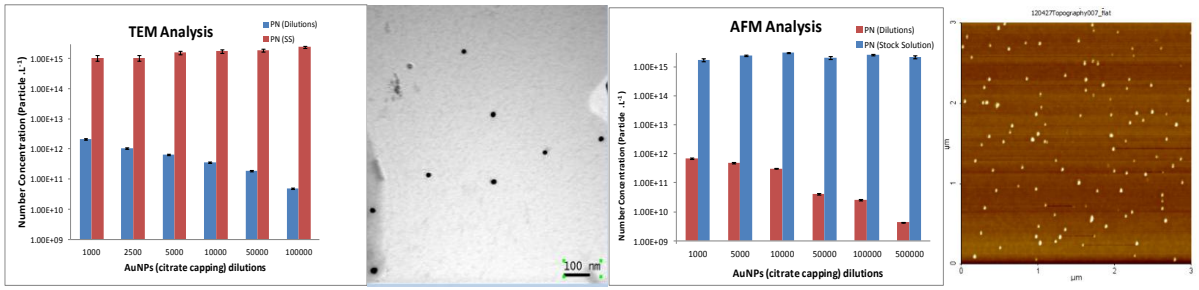

Figure 1: Particle number concentration and micrograph of AuNPs with citrate capping obtained from TEM (Jeol 1200EX) and AFM techniques

Reference:

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