Understanding the significance of sample preparation in studies of the nanoparticle metabolite corona

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Abstract

The adsorption of metabolites to the surface of nanomaterials is a growing area of interest in the field of bio-nano interactions. It is thought that the metabolite corona has a key role in the uptake, distribution and toxicity of nanomaterials in organisms similar to its more established protein counterpart. Previous research has demonstrated that nanomaterials obtain a unique metabolite fingerprint when exposed to biological matrices. However, there have been some concerns raised over the reproducibility of bio-nano interaction research due to challenges in dispersion of NMs and their stability. This work investigates an overlooked aspect of this field, such as, sample preparation, which is vital to the accurate, reproducible and informative analysis of the metabolite corona. The impact of elution buffer pH, volume and ionic strength on metabolite corona composition acquired by uncapped and polyvinylpyrrolidone (PVP) capped TiO_2 from mixtures of cationic and anionic metabolites. We demonstrate the temporal evolution of the TiO_2 metabolite corona and the recovery of the metabolite corona which resulted from a complex biological matrix, in this case human plasma. This work also demonstrates how vital it is to optimize sample preparation for each nanomaterial being investigated, as the metabolite recovery from Fe_3O_4 and dispex capped TiO_2 nanomaterials is significantly reduced compared to the aforementioned uncapped and PVP capped-TiO_2 nanomaterials. These are important findings for future bio-nano interactions studies, which is a rapidly emerging area of research in nanoscience.