

A simple method to estimate the mean number of lipophilic molecules on nanoparticle surfaces by fluorescence measurements

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Abstract

Measurements of fluorescence intensity of the hydrophobic pyridinium salt (DTPSH) remaining in the organic phase after partition experiments in the DCM/H₂O system allowed an approximate method to be developed to estimate the mean number of molecules ($N = 942$) on the surface of 22.8 nm gold nanoparticles and the separation (1.89 nm) between these organic molecules. This protocol is based on the ability that the organic molecules possess to coat the surface of the nanoparticle, which can migrate from the organic to the aqueous phase as a result of the driving force of the strong binding of sulfur to gold. To validate our estimation, we used a projection of the results obtained by Wales and Ulker to solve the Thomson problem, a mathematicians' challenge, used as a model to calculate the mean distance (1.82 nm) separating particles on the surface, in excellent agreement with the results obtained by our method. The quality of results, the simplicity of calculations, the low fluorescence detection limit, and the inexpensive materials, recommend this procedure for rapid estimates of the mean number of molecules on the surface of nanoparticles. © 2021 IOP Publishing Ltd.

Author keywords

fluorescence; gold nanoparticle; pyridinium salt; surface-bound molecules