SELF-CALIBRATED CONCENTRATION MEASUREMENTS OF NANOPARTICLES IN SOLUTION BY SINGLE PARTICLE IMAGING

Ghent University is seeking companies interested in commercializing a measurement method for single particle tracking analysis through a patent license or a collaborative research project.

Introduction

The analysis of nanoparticles has applications in a broad range of sectors. While measuring accurate nanoparticle concentration remains a challenge, single particle tracking has been reported as a promising novel tool in this respect. However, until now single particle tracking concentration measurements are hampered by the need to calibrate the detection volume which depends on several variable parameters, such as particle brightness and image processing settings. The method presented here solves this problem and offers highly accurate self-calibrated concentration measurements.

Technology

Single particle imaging is becoming an increasingly popular tool to characterize particles in solutions. By imaging nanoparticles undergoing Brownian motion in a dispersion, the effective volume of the detection region can be estimated by measuring the nanoparticle residence time and its diffusion coefficient. This method, therefore, enables self-calibrated particle concentration measurements. Furthermore, a rigorous correction is implemented for the classical overestimation of small size particles which have a higher mobility.

Applications

Concentration measurements of nanoparticles in liquid and gaseous media are of great importance in numerous applications. The current technique can be used both for clear liquids and absorptive media such as blood. Relevant application areas are:

- Drug delivery nanoparticles
- Endogenous nanoparticles for biomedical diagnostics
- Nanoparticles for in vivo imaging
- Protein aggregation
- Virus like particles
- Additives in oil and petro-chemistry

Advantages

- Accurate assessment of the size of the measurement volume without need for calibration tools resulting in easier and more accurate measurements
- Correction for the higher mobility of smaller particles resulting in a more accurate measurement of the concentrations of poly-disperse particle dispersions
- Measurement of both low and high concentration dispersions

State of development

In an experiment performed on water dispersions of fluorescent polymer nano-spheres with well-known concentration, we have demonstrated the validity of the proposed method in a controlled setting. Moreover, we have applied the method to estimate concentrations of plasmid DNA molecules and the average number of DNA molecules complexed with liposomal drug delivery particles.

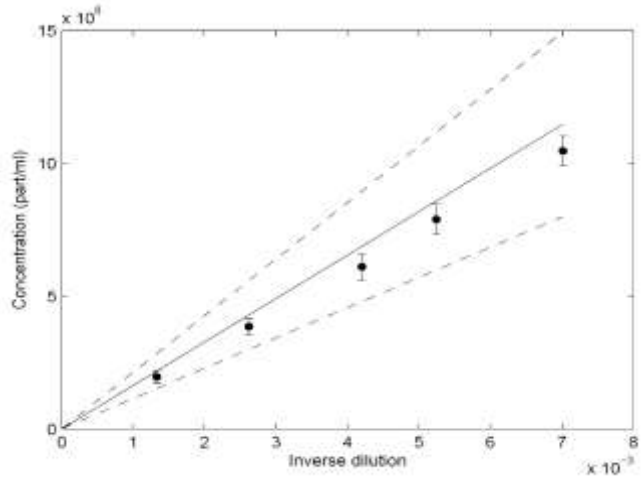
Partnership

Ghent University is seeking companies interested in commercializing a measurement method for single particle tracking analysis through a patent license or a collaborative (subsidized) research project.

Intellectual property

Patent title: Method and system for dispersion measurements
European patent application EP2591333
Granted US patent US9483440

Figure



Concentrations estimated by the model with 95% confidence intervals for 5 different dilutions of a stock suspension of 0.5 µm microspheres. The solid and dashed lines show the theoretical concentration with 95% confidence intervals.

Reference

Approximate Bayesian computation for estimating number concentrations of monodisperse nanoparticles in suspension by optical microscopy. Magnus Röding, Elisa Zagato, Katrien Remaut and Kevin Braeckmans (2016) PHYSICAL REVIEW E. 93(6).

Keywords

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