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A Comparative Analysis of Nanoparticle Measuring Techniques

INTRODUCTION

- The objective for the project is to establish a streamlined methodology for assessing the size stability of nanoparticles, ensuring reproducibility and consistency in drug delivery applications.
- This will be done by comparing the sizing results obtained from Dynamic Light Scattering (DLS) with Transmission Electron Microscopy (TEM), and Nanoparticle Tracking Analysis (NTA) to validate the accuracy and reliability of the rapid assessment.
- We used 2 types of nanoparticles for each of the 3 measurement techniques:
 - 100nm diameter Gold Nanoparticles from a stabilized citrate buffer suspension and diluted in deionized water.
 - The other type were Mesoporous Silica Nanoparticles (MSN) diluted in DI water.
- In the future, the sizing protocol could be integrated into existing computational models, enhancing predictive capabilities for drug release kinetics.



METHODOLOGY & RESULTS

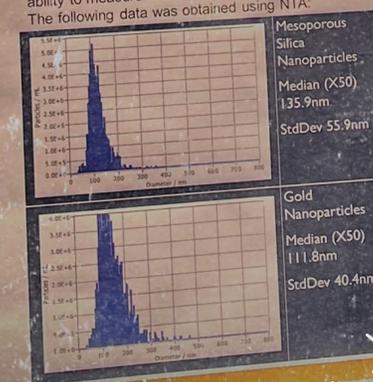
Transmission Electron Microscopy (TEM) involves preparing a dilute solution of nanoparticles on a support grid, which is then targeted with a beam of electrons. As the electrons pass through the sample, they interact with the nanoparticles, revealing their structure. The resulting images can be magnified to extremely high levels, enabling precise measurement of nanoparticle size, shape, and distribution.

METHODOLOGY & RESULTS

The following images were obtained using TEM:



Nanoparticle Tracking Analysis (NTA) involves illuminating the sample with a laser and tracking the Brownian motion of individual nanoparticles under a microscope. Specialized software analyzes the particle trajectories to determine size and concentration. NTA offers high resolution and the ability to measure a wide size range.



METHODOLOGY & RESULTS

Dynamic Light Scattering (DLS) analyzes nanoparticles' size distribution by analyzing the fluctuations caused by Brownian motion through the sample illuminated. The resulting scattered light is analyzed for intensity, correlating the information to the particle size. The following data was obtained using DLS:

Meso Nanoparticles (in DI water) 328.8nm

CONCLUSION

The unimodal distribution of the nanoparticles was confirmed by the narrow size distribution. The results of the NTA and DLS analysis were compared to the TEM images to validate the accuracy of the rapid assessment. The results of the NTA and DLS analysis were compared to the TEM images to validate the accuracy of the rapid assessment.

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