ORT_17 - Continuous Flow Synthesis of Monodisperse Gold Nanoparticles

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Introduction: Metallic nanoparticles play a crucial role in various applications, particularly in bio/chemical sensors, due to their strong absorption in the visible light region known as plasmon resonance absorption. The demand for monodisperse metallic nanoparticles with a low coefficient of variation (CV) is high, necessitating precise synthesis methods. This study focuses on the continuous flow synthesis of monodisperse gold nanoparticles using a glass microfluidic device.

Objectives: The primary objective of this research is to investigate the effects of channel width and flow rate on the size distribution of the synthesized gold nanoparticles. By controlling these parameters, the aim is to achieve monodisperse nanoparticles with a small size distribution and high uniformity.

Methodology: The synthesis process involves injecting an aqueous solution of tetrachloroauric (III) acid as the source of Au ions, along with a mixture of sodium citrate acid as the reducing agent and tannic acid as the protective agent, into a microchannel in the microfluidic device using a syringe pump. The absorption spectra at different flow rates are analyzed to determine the impact of channel width and flow rate on the nanoparticle size distribution.

Results: Experimental results show that lower flow rates lead to sharper absorption peaks compared to higher flow rates, indicating better size uniformity in the nanoparticles. The combination of a low-flow rate and a small channel width results in monodisperse gold nanoparticles with a small mean diameter and low coefficient of variation.

Conclusion: The study demonstrates that precise control of channel width and flow rate in a continuous flow synthesis process is essential for producing monodisperse gold nanoparticles with high uniformity. By optimizing these parameters, it is possible to achieve nanoparticles with a small size distribution, meeting the requirements for various applications in sensing and nanotechnology.

Keywords: Gold Nanoparticles; Continuous flow synthesis; Microfluidic device