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Production of biocompatible gold nanoparticles for drug delivery using droplet based glass capillary microfluidic [Abstract]

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Production of biocompatible gold nanoparticles for drug delivery using droplet based glass capillary microfluidic

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Gold nanoparticles (AuNPs) are increasingly investigated in academia and industry alike because of their unique properties amongst which biocompatibility, versatility and relatively easier synthesis and easier detection. The biocompatibility feature makes AuNPs an excellent candidate for drug and gene delivery applications while surface plasmon resonance makes them a good candidate for imaging and diagnostic applications. Currently, the most common method to synthesise AuNPs is via batch-wise reduction reaction between a gold salt and a reducing agent. The method suffers from several limitations particularly poor control of both particle size and polydispersity due to poor control of mixing and batch-to-batch variation. The objective of this research is to develop a reliable method for a continuous production of well controlled AuNPs. As such, a chemical reduction of tetrachloroaurate trihydrate (gold salt) by ascorbic acid was carried out, at room temperature, using a 2 phase reaction droplet based glass capillary microfluidic device. This method showed enhanced control of the size and polydispersity index (PDI) compared to the results we obtained previously using a single phase co-flow glass capillary microfluidic device (Bandulasena et al., 2017 – submission stage for publication). The investigation showed that particle size strongly depends on the droplet size as smaller particles were obtained with smaller droplets. One effective way to fine tune the droplet size was achieved by manipulating the outer phase flowrate. In addition, smaller droplets can be obtained using smaller collection capillary orifice diameter. Both methods were successfully used to synthesise AuNPs with controlled size. As a future development, the method will be extended to the simultaneous synthesis and functionalization of AuNPs (continuous integrated approach).