DNA silver nanoclusters: The effect of the secondary DNA structure on fluorescence

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Advancements in nanoparticle engineering have opened multiple doors for new and improved bioimaging and theranostic applications. In particular, atomically accurate nanoclusters can be synthesised using biocompatible stabilisation agents (such as oligonucleotides, proteins and aptamers), which exhibit specific fluorescent and targeting functionality [1]. Oligonucleotide (single strands of DNA) stabilised silver nanoclusters consist of <20 silver atoms and are synthesised using a well established method, where silver nitrate in the presence of oligonucleotide is reduced using sodium borohydride. By simply changing the oligonucleotide base sequence and reaction conditions, the fluorescence and cluster size can be varied.

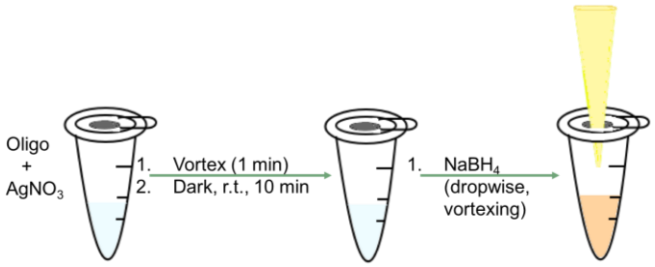

Fig. 1 Schematic representation of the synthesis of oligonucleotide stabilised silver nanoclusters.

Characterisation of the oligonucleotide stabilised silver nanoclusters was done using matrix assisted laser desorption spectroscopy to determine the size of the cluster and observe the fragmentation. Thermal studies were conducted using circular dichroism and fluorescence spectroscopy enabling the insight into the secondary structure of the oligonucleotide and origin of fluorescence, which to date remains elusive [2]. We are also using these oligonucleotide stabilised silver nanoclusters as targeted bioimaging and antibacterial agents [3,4]. Additionally, we have incorporated these oligonucleotide stabilised nanoclusters with DNA dendrimers and conjugated to aptamers for enhanced and targeted fluorescence.

1) C. I. Richards, *et al.*, *J. Am. Chem. Soc.*, **2008,** 130, 5038.
2) B. Sengupta, *et al.*, *Molecules*, **2016**, 21, 216.
3) J. Li, *et al.*, *Anal. Chem.*, **2012**, 84, 4140.
4) S. Javani, *et al.*, *ACS Appl. Mater. Interfaces*, **2016**, 8, 10147.