Since the discovery of catalytically active gold nanoparticles, this field of study has flourished with numerous reviews discussing the vast array of nano-gold catalysts, their high efficiency and merits as green catalysts.\(^1\) As with many nanocatalysts, gold nanoparticles are highly reactive and suffer from severe agglomeration, however, highly efficient core-shell nanocatalysts based on active gold nanoparticles and silica cores or shells have recently been reported.\(^2\) The incorporation of silica into gold or metal-based nanocatalysts not only reduces cost but also heterogenises the catalyst, thus allowing for catalyst recycling. Additionally, stability of the gold nanoparticles on the silica surface can be controlled by functionalising the surface of the silica core via the surface silanols.\(^3\) The synthetic routes are highly controlled, facile and inexpensive, thus allowing the formation of uniform heterogenized catalysts for highly efficient and recyclable catalysis.

In this paper, the design, synthesis and characterisation of gold-decorated amino-functionalised silica nanoparticles (Au-AMPS-SS\(_x\)) will be reported. A three-step synthesis was developed with a focus on repeatability and ease. Initially, Stöber methods were used to generate a range of silica core nanoparticles\(^5\) (20 - 100 nm) via an optimized method. Next, the silica nanoparticle cores were functionalized with (3-aminopropyl)trimethoxysilane (AMPS).\(^6\) Finally, the decoration of the nanoparticle cores with gold nanoparticles (2 – 5 nm) was achieved via a simple deposition-precipitation process.\(^7\)

The success of the design of these Au-AMPS-SS\(_x\) nanoparticles was evaluated by monitoring the stability over time, as well as their efficiency as heterogeneous catalysts. The catalytic reductive degradation of methylene blue, an organic dye, was carried out to evaluate the catalytic activity of the Au-AMPS-SS\(_x\) nanoparticles. Not only are organic dyes raw materials used in various industries, but they produce highly coloured effluents that are potentially carcinogenic and toxic to aquatic systems, thus, cost-effective green catalysts are sought for the degradation of these dyes.\(^8\)

**Figure 1.** Schematic representation and TEM micrograph (right) of Au-AMPS-SS\(_x\)**

References


**Corresponding author email:** 15288013@sun.ac.za