CYSTEINE GOLD NANOPARTICLES IN OPEN-TUBULAR CAPILLARY ELECTROCHROMATOGRAPHY

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Gold nanoparticles which are known for thousands years started their progress in 19th century. Nowadays gold nanoparticles are used in several fields of chemistry, physics, materials, medicine, and optics due to their unique physical and chemical properties (ref. 1). However, their applications in the separation science are still relatively rare. Nanoparticles have been successfully used to enhance optical and electrochemical detection and separation (ref. 2).

Gold nanoparticles usable in separation techniques can be prepared by several means. The most frequent approaches are: first, citrate reduction of aqueous solution of a gold(III) salt; second, borohydride reduction of aqueous solution of a gold(III) salt; and third, two phase (water-toluene) reduction using borohydride as reducting agent and tetraoctylammonium bromide as transfer agent of gold(III) salt. Each method provides different concentration and size of the generated nanoparticles as well as the different potential for their subsequent modification (ref. 3). Most of the applications are related to capillary electrochromatography where nanoparticles have been added to the run buffer or coated to the walls of a capillary (ref. 3). The immobilization of the gold nanoparticles onto the inner surface of a fused-silica capillary can be carried out applying layer-by layer technique (ref. 4) or covalent modification *via* (3-mercaptopropyl)trimethoxysilane (ref. 5).

The functionality of biological compounds is based on chirality. The chirality of compounds is crucial factor in living organisms, therefore enantiospecific analysis is very important in the separation techniques. Although Wang et al. reported use of chiral molecule cysteine modified gold nanoparticles in capillary electrophoresis, they only used this system for separation different compounds, not enantiomers (ref. 4).

In this work the gold nanoparticles were prepared by citrate reduction of a gold(III) salt. In the next step, the citrate stabilized nanoparticles were modified with cysteine at different concentrations. The resulting nanoparticles were characterized by absorption spectroscopy and transmission electron spectroscopy and used for the immobilization into the capillaries. The fused-silica capillaries were pre-derivatized by (3-mercaptopropyl)trimethoxysilane that allows a covalent modification of the capillary walls with the modified gold nanoparticles (Fig. 1). These capillaries were used to separate the enantiomers of selected aminoacids and the effect of the concentration of immobilized cysteine, concentration of the immobilized nanoparticles, pH of the running buffer, and other factors is discussed.

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Figures:

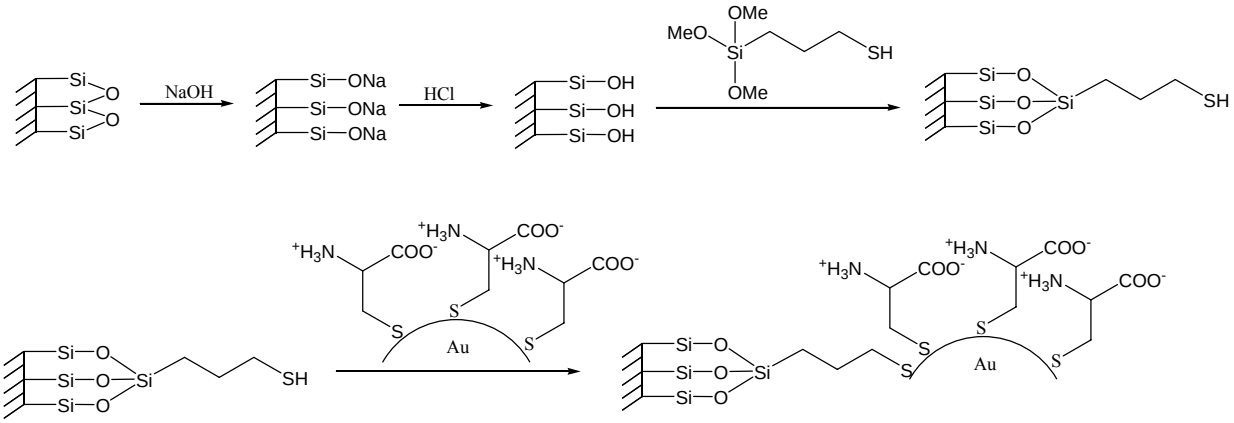

Figure 1. Schematic preparation of capillary modified by gold nanoparticles