Application of Bare Gold Nanoparticles in Open-Tubular CEC Separations of Polyaromatic Hydrocarbons

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Nanoparticles (NPs) are objects of variable shapes with the dimensions in the range of units to hundreds of nanometers possessing unique physical and chemical properties [1, 2]. Typical features of NPs are a large surface-to-volume ratio and other fascinating properties derived from the "quantum size effect" [2]. NPs have significantly influenced many fields of science including analytical separation and preconcentration of a variety of analytes. The potential of gold NPs (GNPs) in separation science has been recognized at the beginning of this century and since then a bunch of interesting papers on this topic has been published as further documented by several cited papers. In capillary electromigration techniques, the GNPs can serve either as permanent or dynamic inner surface coatings in open-tubular capillary electrochromatography (OT-CEC) [3–5] or as pseudostationary phases in partial filling or continuous filling mode in micellar electrokinetic chromatography (MEKC) [6]. Lately, also the potential of the GNPs for sample preconcentration have been distinguished and this area undergoes a dynamic progress [7, 8]. Recently, several detailed review papers devoted specifically to the applications of GNPs in separation science have been published [9, 10].

In OT-CEC mode, GNPs modified with alkylthiols of various chain lengths are used in applications where hydrophobic compounds are separated in reversed-phase (RP) mode [3-6, 11]. While the use of bare GNPs for the preconcentration of various compounds has been successfully demonstrated elsewhere [9, 10], to the best of our knowledge, the separations utilizing bare GNPs immobilized on pretreated sol-gel FS capillary as stationary phase in OT-CEC mode is described for the first time.

In this study, bare gold nanoparticles (GNPs) immobilized in the sol-gel pretreated fused silica (FS) capillary as a stationary phase for open-tubular capillary electrochromatography (OT-CEC) are for the first time shown to be able to separate hydrophobic polyaromatic hydrocarbons (PAHs). Model mixture of four PAHs, naphthalene, fluorene, phenanthrene, and anthracene, was resolved by OT-CEC in the GNPs modified FS capillaries using the hydro-organic background electrolyte (BGE) composed of 20 mmol/L podium phosphate buffer, pH 7, modified with acetonitrile at 8/2 (v/v) ratio.

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