

Potential of Surface-Enhanced Raman Scattering Detector for Capillary Electrophoresis

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Surface-Enhanced Raman Spectroscopy (SERS) is interdisciplinary method covering vibrational spectroscopy, plasmonics and nanotechnologies. This method is based on the enhancement of the weak Raman scattering of molecules in a close proximity of metal nanomaterials, such as metal nanoparticles, roughened surfaces or metal tips. The enhancement factor could reach a value up to 10^{14} [1,2], and thus SERS becomes a high sensitive analytical method. In most of the applications, SERS was used as a stand-alone method. However, relatively little attention was focused to on-line coupling of SERS with separation methods such as liquid chromatography or capillary electrophoresis [3,4]. Nirode et. al. published a simple way to integrate the on-column SERS detection in CE by usage of SERS-active silver nanoparticles suspended in the background electrolyte [3]. Leopold et. al. prepared a spot of SERS substrate by laser-induced citrate reduction of silver nitrate during the CE separation [4].

This presentation is devoted to a new, simple photodeposition method of silver nanoparticles inside a fused-silica capillary induced by laser [5]. The photodeposited compact spot of a size of $\sim 10 \mu\text{m}$ is temporary and spatially stable and resistant to a hydrodynamic flow. The advantage of this approach is that neither the silver nanoparticles nor the chemicals for their preparation are components of the background electrolyte during the electrophoretic separation. Thus, the substrate formation and separation of analytes are two independent processes and can be performed under their optimum conditions. The zone broadening due to the sorption of analytes on the immobilized nanoparticles can be significantly reduced by an addition of 20% solution of methanol. The efficiency of capillary electrophoresis and detection selectivity of surface-enhanced Raman scattering is demonstrated by the 3D electropherograms of rhodamines 123 and B as model samples.

References

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