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Nanoparticle-enhanced liquid-phase microextraction

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HIGHLIGHTS

- The role of nanomaterials in liquid-phase microextraction
- Carbon nanotubes used for reinforcing dispersive liquid-liquid microextraction
- Magnetic nanoparticles combined with hollow-fiber liquid-phase microextraction
- Affinity probes for matrix-assisted laser desorption/ionization mass spectrometry
- Fluorescent nanoparticles used as extraction probes and nanosensors in drop format

ABSTRACT

Nanostructured materials play roles in different areas of analytical chemistry. Implementation of nanomaterials in liquid-phase microextraction results in a synergic combination yielding enhanced performance. Some significant examples include: carbon nanotubes for improving extraction efficiency; magnetic nanoparticles for retrieval ionic liquids or organic solvents; metal nanoprobes in a solvent microvolume for desalting and ionization in the analysis of proteins and peptides by matrix-assisted laser desorption/ionization-mass spectrometry; *in situ* generation of noble-metal nanoprobes for extraction of hydride-forming elements prior to their determination by atomic spectrometry; confinement of fluorescent nanoprobes in a microvolume of organic solvent, thereby integrating separation, preconcentration and analyte recognition within a single step; and, solid-phase extraction involving nanomaterials and liquid-phase microextraction in a sequential way. We provide insight into significant advances involving the joint use of nanomaterials and liquid-phase microextraction.

Keywords:
Affinity
Carbon nanotube
Liquid-phase microextraction
Magnetic nanoparticle
Nanomaterials
Nanoparticle
Nanoprobe
Noble metal
Oxide nanoparticle
Quantum dot

Abbreviations: AAS, Atomic absorption spectrometry; APDC, Ammonium pyrrolidine-dithiocarbamate; CE, Capillary electrophoresis; CNT, Carbon nanotube; CPE, Cloud-point extraction; DI-SDME, Direct immersion-single drop microextraction; DLLME, Dispersive liquid-liquid microextraction; D-micro-SPE, Dispersive micro-solid phase extraction; DSDME, Directly suspended drop microextraction; EF, Enrichment factor; ETAAS, Electrothermal atomic absorption spectrometry; ETV-ICP-MS, Electrothermal vaporization-inductively-coupled plasma mass spectrometry; FAAS, Flame-atomic absorption spectrometry; GC-ECD, Gas chromatography-electron capture detector; GC-FID, Gas chromatography-flame ionization detector; GC-MS, Gas chromatography-mass spectrometry; HF, Hollow fiber; HPLC, high performance liquid chromatography; HS-SDME, Headspace-single-drop