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How to detect metal species preconcentrated by microextraction techniques?

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Highlights

- Problems and limitations with detection of metal ions by spectroscopy techniques
- Current trends in preconcentration of inorganic species by microextraction
- Recent strategies used for introduction of micro-samples to spectroscopic systems

Abstract

Microextraction techniques, both liquid-liquid and solid-phase microextraction, are becoming increasingly popular as a sample pre-treatment step mainly due to their simplicity and environmental-friendliness. Nevertheless, the small amount of the sample obtained after preconcentration step requires application of special measurement techniques and/or development of different strategies used for introduction of micro-samples into spectroscopic instruments and chromatographs. In this review the most recently approaches that have been applied for introduction of micro-amounts of samples into different measurement systems are presented. Advantages and disadvantages of developed sample introduction systems as well as new achievements in these approaches are discussed in details.

Keywords: Trace analysis; Liquid-liquid microextraction; Solid phase microextraction; Dispersive micro-solid phase extraction; Speciation; Preconcentration; Spectrometry; Chromatograpy

Abbreviations

AAPTS, N-(2-aminoethyl)-3-aminopropyltrimethoxysilane**; AAS**, atomic absorption spectrometry; **APDC**, Ammonium pyrrolidinedithiocarbamate; **CAR,** Carboxen^{TM}; **CME**, Capillary microextraction; **CNTs**, Carbon nanotubes; **CV-AAS**, Cold-vapor atomic absorption spectrometry; **DDTC**, Sodium diethyldithiocarbamate; **DL**, Detection limit; **DLLME**, Dispersive liquid-liquid microextraction; **DMSPE**, Dispersive micro-solid phase extraction; **DSDME**, Directly suspended droplet microextraction; **DVB,** Divinylbenzene; **EB-DLLME**, Emulsification-based dispersive liquid-liquid microextraction; **EDXRF**, Energy-dispersive X-ray fluorescence spectrometry; **ET-AAS**, Electrothermal atomic absorption spectrometry; **ETV-ICP-MS**, Electrothermal vaporization inductively coupled plasma mass spectrometry; **ETV-ICP-OES**, Electrothermal vaporization inductively coupled plasma optical emission spectrometry; **F-AAS**, Flame atomic absorption spectrometry; **FI-HG-AAS**, Flow injection-hydride generation atomic absorption spectrometry; **FI-ICP-MS**, Flow injection-inductively coupled plasma mass spectrometry; **GC-ICP-MS**, Gas chromatography-inductively coupled plasma mass spectrometry; **GC-MS**, Gas chromatography-mass spectrometry; **G-COOH**, Carboxylated graphene; **GO**, Graphene oxide; **GO-NH_2**, Aminosilanized graphene oxide, **GO-SH,** Mercapto-modified graphene oxide; **HF-LPME**, Hollow fiber-liquid phase microextraction; **HG-AAS**, Hydride generation atomic absorption spectrophotometry; **HPLC**, High performance liquid chromatography; **HSSE**, Headspace sorptive extraction; **HS-SPME,** Headspace solid phase microextraction; **ICP-MS**, Inductively coupled plasma mass spectrometry; **ICP-OES**, Inductively coupled plasma optical emission spectrometry; **IL**, Ionic liquid, **IL-DLLME**, Ionic liquid dispersive liquid-liquid microextraction; **IL-LPME**, Ionic liquid-liquid phase microextraction; **LA-ICP-MS**, Laser ablation