

New Strategies for Trace Elements and their Species Analysis in Cells

Bin Hu*, Beibei Chen and Man He
Wuhan University, China

Inductively coupled plasma mass spectrometry (ICP-MS) is one of the most effective techniques for trace elements analysis due to high sensitivity, wide linear range, multi-isotopes/elements simultaneous detection ability. However, direct ICP-MS determination of trace elements and their species in cells is still faced with tremendous difficulties: (1) The instrumental detection limits usually do not meet the requirements of trace analysis in a small number of cells; (2) Limited amount of cells does not match the sample consumption in conventional ICP-MS analysis; (3) Cell sample would cause serious matrix effects; (4) Elemental species cannot be identified by ICP-MS. Therefore, a sample pretreatment technique is a prerequisite to preconcentrate interested elements/species and separate cell matrix. Microfluidic chips, with high integration and miniaturization properties, combined with ICP-MS provide a potential platform for trace elements and their species analysis in cells.

We have integrated various extraction techniques on microfluidic chips (including chip-based liquid phase microextraction, chip-based magnetic solid phase microextraction and chip-based monolithic microextraction) and combined them with electrothermal vaporization/HPLC-ICP-MS for trace elements and their species analysis in cells, which provide LODs at ng/L level and reduce the consumed cell numbers to several hundred per analysis. Moreover, a new strategy was proposed by on-line combining droplet chip with time-resolved ICP-MS for the analysis of zinc in single cell. The developed on-line droplet chip-ICP-MS single cell analysis system provided a very high throughput (droplet generation frequency of $3\text{--}6 \times 10^6 \text{ min}^{-1}$), showing a good application potential in the distribution study of trace elements in single cells.

Biography:

Bin Hu is a full Professor of chemistry at Wuhan University, Vice-Dean of the College of Chemistry and Molecular Sciences at Wuhan University, China and Vice-director of the Key Laboratory of Analytical Chemistry for Biology and Medicine of the Ministry of Education of China. His research interests concern hyphenated techniques for metallomics, electrothermal vaporization as a sample introduction technique for plasma spectrometry (ICP-OES/MS), novel microextraction techniques and advanced functional materials for spectrometric analysis and ICP-MS based strategies for bioanalysis. Professor Hu is an Editorial Advisory Board member for J. Anal. At. Spectrom., Spectrochim. Acta Part B and Appl. Spectrosc. Rev.