

A fully automatic multi-ions/species purification system for elemental/isotopic analysis

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A syringe based instrument is developed in this study, which could be used to purify ions for isotopic analysis, isolate ion species for speciation analysis and concentrate trace metals ions for elemental analysis. The instrument allows sample loading, multiple acid washes, column conditioning, and elution at a user-defined flow rate and/or volume. The precisely controlled syringe pump, low memory volume, and fully PFA system ensure accurate isolation of elements or species for analysis with an ultra-low blank.

The overall concept of the instrument is similar to an ion chromatography workstation, the innovation of the instrument is a valve connected with two chromatographic columns (column A and B). Through the switching of the valve, the instrument could realize five elution schemes: (1) no chromatographic columns working state, which could be applied as a micro-volumes injection system for isotopic analysis, especially when the sample is precious. (2) column A and B are arranged in series, which could be filled with two different kinds of resins. (3) single column A working state. (4) single column B working state. The single column working state is designed for those elements that could be isolated with one resin. (5) the single column A with the backflush working state. Through the backflushing, the sub-pt metal ions in the high matrix could be concentrated with extremely low elution volume to achieve an accurate analysis of them.

During a single experiment, the five working modes could be any combination without limitation, if coupled with the self-defined resins in column A and B, the instrument could be applied to automatically isolate Li, B, K, Mg, Ca, Cu, Fe, Zn, Mo, Rb, Sr, Ba, La, Ce, Nd, Sm, U, Th, Pb and so on for isotopic analysis. It could also be used as a micro-volume injection system for the ICP to save the samples; a pre-concentrate system for ultra-low REE content samples; and a species analysis system (for example: As, Cr, Hg, Se, and Halogen speciation).

The instrument is flexible of multi-functions, which could be applied to geosciences, biology, food safety, environmental monitoring, and forensic marks.