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Investigation of capillary ion chromatography (Cap-IC) for nuclear prospects

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The recent development of commercial capillary ion chromatography (Cap-IC) systems [1-4] provides a major opportunity to increase the reactivity of laboratories and to reduce the amount of radioactive effluents produced from the chromatographic analyses in the nuclear field. As the column replacement in a radioactive environment is tedious, the retention behavior of IC columns was investigated at capillary scale to anticipate this operation.

Evolution of retention behavior of Cap-IC columns

Evolution of retention factors over several months for AS15 and AS10 capillary columns (a) AS15/AG15 0.4 x 250 mm N°1, commercial ICS-5000 system, 38 mM KOH, 12 µL/min, 30 °C (b) AS10/AG10 0.4 x 250 mm, modified ICS-5000 system, 85 mM KOH, 10 µL/min, 30 °C

- Linear decrease of retention factors as a function of the operating time of the Cap-IC columns whatever the type of columns and the studied anions
- No decline for cation-exchange Cap-IC columns

Validation of Cap-IC

Quality Control (QC) charts obtained for QC standards analyzed with the same calibration curve during 18 days

- Accurate quantification of all anions by using the same calibration curve during 18 days

Results for SO$_4^{2-}$

- No bias observed for the two laboratories using Cap-IC whatever the analyzed anions

Novel aspect

Despite the linear decrease of retention factors observed for anions, the analytical performance of capillary ion chromatography was validated with an interlaboratory comparison exercise, which makes this technology convenient for applications to radioactive samples. This work is of prime interest for nuclear analysts but also for IC users who intend to increase the flexibility and the reactivity of their laboratories.

2) CA Lucy et al. (2013) Advances in High-Speed and High-Resolution Ion Chromatography. LC GC Europe 31:38-42.