Potential of a novel low-flow *drop-on-demand* aerosol generator for plasma spectrochemical and speciation analysis

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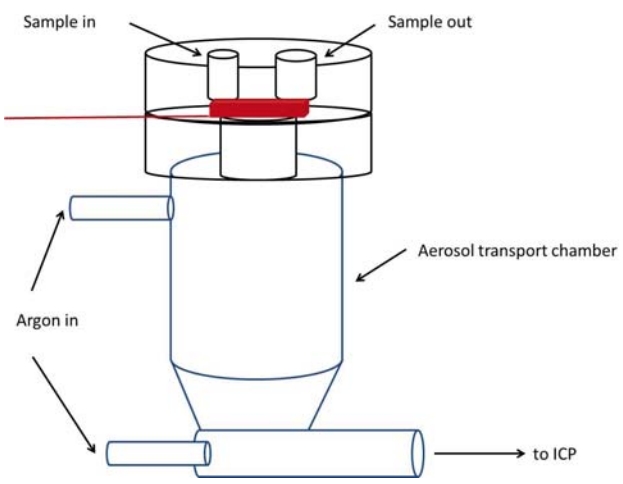
Liquid sample introduction in plasma spectrometry

In the field of inorganic trace and species analysis, the common way to introduce liquid samples into plasma excitation and ionization sources is pneumatic nebulization. Especially when modern low flow separation techniques are hyphenated to ICP-MS an efficient aerosol generation is indispensable. Commonly, an additional make-up solvent flow has to be added to the eluent flow to meet the specifications of conventional modern nebulization systems for sample introduction into the plasma source. However, this might not only degrade the chromatographic resolution but also result in an unfavourable loss of sensitivity and the risk of contamination.

"Drop-on-demand" aerosol generator

A novel approach for the generation of aerosols, based on thermal-inkjet technology has been successfully demonstrated. This new *drop-on-demand* (DOD) aerosol generation system is capable to generate efficiently aerosols at very low sample flow rates from nL / min up to some mL / min[1]. However, changing the sample and rinsing the device was quite cumbersome with the first versions of the aerosol generator. The aim was to hyphenate the dosing device with standard liquid handling devices such as flow injection and autosamplers. Since the flow rates of common peristaltiv pumps are much higher than the dosing rate of the new DOD aerosol generator, the modification of the dosing device includes capillary tubes, which allow a continous flow-through of the sample. This way, rinsing the system becomes very easy.



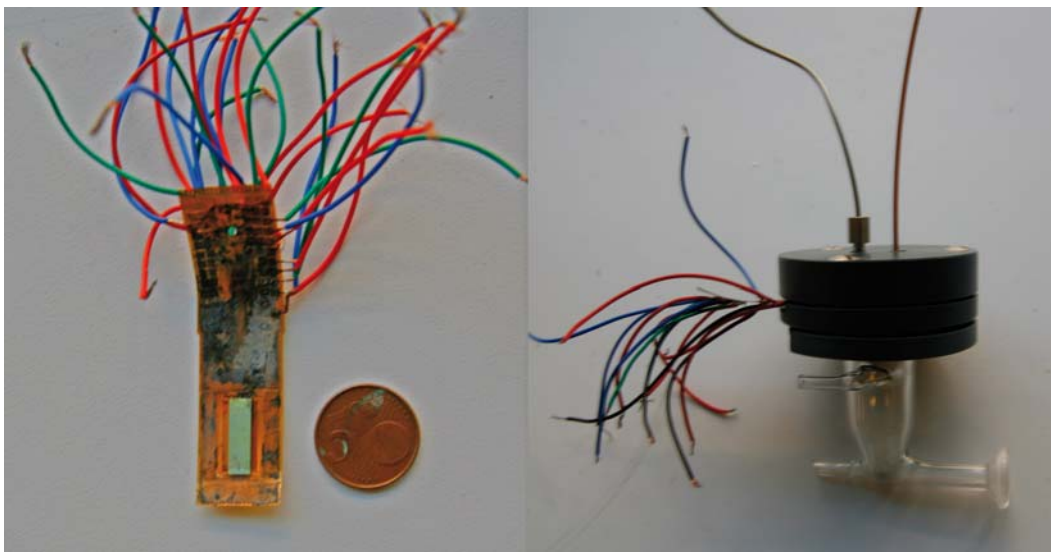


Figure 1: Schematics of a low-dead-volume interface for coupling HPLC with ICP-MS based on a modified HP45 printing cartridge.

Fig. 1 shows the modification of a commercially available thermal inkjet printing device. Only the print head is mounted on a custom-made glass aerosol transport chamber and capillaries conncet the liquid reservoir. If this liquid reservoir is kept very small, even separation techniques like high performance liquid chromatography (HPLC) can be applied to the new *drop-on-demad* aerosol generator. A conventional HPLC system (PerkinElmer Series 200) equipped with a standard ionchromatography column was used to carry out chromatography experiments. To compare the chromatographic resolution, a UV/Vis detector (Linear UVIS 204) was used.

Chromatography

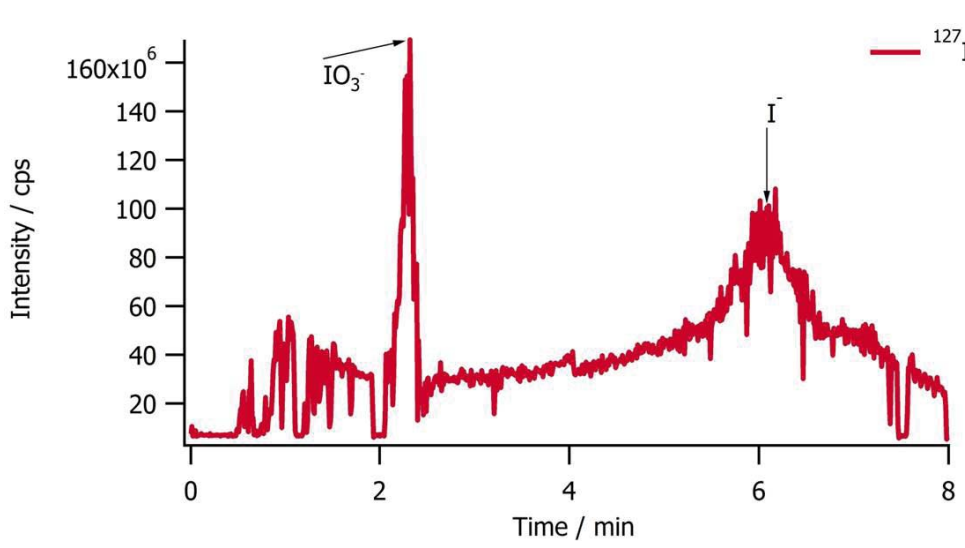


Figure 2: Separation of iodine and iodate - DOD-ICP-MS detection

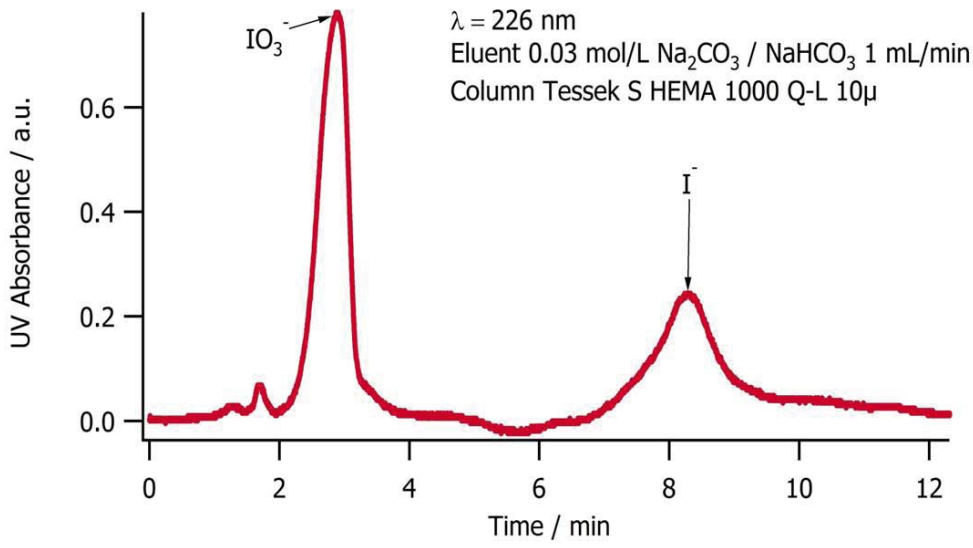


Figure 3: Separation of iodine and iodate - UV/Vis detection

Fig. 2 shows the separation of iodine and iodate with ICP-MS and the use of the new DOD aerosol generator (left) compared to UV/Vis detection (right). Both species are well resolved by ionchromatography and can be identified clearly. The retention times for the UV/Vis detection shift a little bit due to necessary higher concentration used in these experiments

Conclusion and Outlook

It could be shown, that the new low-dead-volume (approx. 2 µL) interface allows easy coupling of conventional separation techniques to the developed new aerosol generation system. Further downscaling of the deadvolume is planned, as minaturized flow systems fit the demands of the new aerosol generator, too. Also the robustness of the developed DOD system against solvents will be investigated in the future to dertermine the systems' limitations in modern HPLC-ICP-MS.

References

[1] Schaper, J. Niklas, Massmann, Jan, Petersen, Jan H., Bings, Nicolas H.; XXXIV Colloquium Spectroscopicum, Budapest (Ungary) **2009** (poster).

Acknowlegment

The authors would like to thank Peter Schöffel and Waldemar Maidanjuk from the machine shop of the institute for inorganic and analytical chemistry of the University of Mainz for their practical help as well as the German Research Foundation (DFG) and the interdsiciplinary research training program "Trace analysis of elemetal species: development of methods and applications" for financial support.