Comparison of chemical and electrochemical hydride generation for the on-line determination of arsenic species with an atmospheric pressure glow discharge in helium

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Most glow discharges described up to now were operated under reduced pressure. In this case it is not easy to handle glow discharges for the analysis of many samples as on-line use is difficult. Therefore atmospheric pressure glow discharges (APGD) are developed and characterized for on-line use with advanced types of sample introduction. Such plasmas can be made use of to directly analyze gaseous samples with mass spectrometry or optical emission spectrometry. A further advantage as compared to the ICP is their very low gas flow (~1% of the one of the ICP).
In this study an APGD in helium was used as radiation source to determine volatile hydride forming elements by optical emission spectrometry. The effects of different electrodes and mountings were investigated.
To produce hydrides, chemical and electrochemical (EcHG) hydride generation were used. One disadvantage of chemical hydride generation is the poor stability of sodium borohydride solutions, which therefore must be prepared daily. In electrochemical hydride generation only sulphuric acid is required and the concentration of this acid can be monitored and kept constant.
A new electrolysis cell for EcHG was developed which is divided into an anode and a cathode compartment by a Nafion® membrane. The efficiency of this cell was determined and the effectiveness compared with the one of other electrolysis cells.
The combination of EcHG and APGD has been optimized and figures of merit such as the limit of detection, the precision and sensitivity as well as the response to different species of arsenic were compared with those of chemical hydride generation APGD. The applicability to environmental and industrial samples will be shown.