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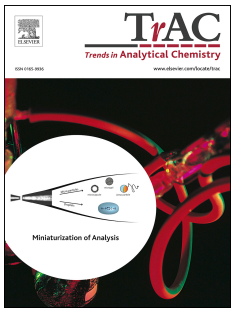

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Critical evaluation of recent achievements in low power glow discharge generated at atmospheric pressure between a flowing liquid cathode and a metallic anode for element analysis by optical emission spectrometry

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Abstract

Atmospheric pressure glow discharge (APGD) sustained in air between a metallic pin anode and the surface of a flowing liquid cathode (FLC) solution is a small and compact excitation source, in which the analytes are inherently transported to the discharge during its normal operation through electrospray-like generation of tiny solution droplets and/or sputtering of the FLC solution surface. This survey is devoted to recent development of FLC-APGD in respect to basic researches and its applications in element analysis by optical emission spectrometry (OES). Particular attention is paid to the latest modifications in the construction of the discharge cells and the composition of the FLC solution and their implications for analytical performance of FLC-APGD-OES.

Keywords: Flowing liquid cathode (FLC); Atmospheric pressure glow discharge (APGD); Optical emission spectrometry (OES); Elemental analysis; Analytical performance; Sample preparation

1. Introduction

Direct current (dc) driven atmospheric pressure glow discharge (APGD) sustained in open-to-air type discharge cells in air between a metallic pin anode and the surface of a flowing liquid cathode (FLC) solution is a small and compact excitation source that needs no special sample introduction system like a spray chamber and a nebulizer to transport the analytes to the analytical zone. The analytes are inherently transported to the discharge during its normal operation through generation of tiny solution droplets, like in case of electrospray formation [1], and/or sputtering of the FLC solution surface [2]. As compared to commercially available instruments for analytical optical emission spectrometry (OES) that use bulky atmospheric pressure plasmas (APPs), i.e. inductively coupled plasma (ICP) or microwave induced plasma (MIP), FLC-APGD needs no discharge gases because it is fully sustained in surrounding ambient air saturated with water vapor. Providing good analytical performance at low operating costs, consuming low forward power, i.e. ~30-75 W or a little bit more, and requiring uncomplicated devices [3-12], FLC-APGD is regarded nowadays as one of the most promising and alternative excitation sources that can offer the detection limits (DLs) of many elements being comparable or better than those obtained with ICP-OES [5,6-8,13]. In addition, FLC-APGD-OES presents a relatively low background level and very simple atomic emission spectra with the most prominent analytical lines of elements only. Therefore, likelihood for their spectral interferences with emission bands of diatomic molecular species is relatively small. Appearance of the ionic lines in the emission spectra of