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Abstract

Eight designs of dielectric barrier discharge (DBD) atomizers have been constructed and optimized. Subsequently, their performance with atomic absorption (AAS), atomic fluorescence (AFS) and atomic emission (AES) detectors was investigated employing arsane as a model analyte. Although being all based on a planar shaped quartz body, the individual DBD designs differed from each other in the style of electrode attachment, electrode shape and area as well as electrode distance. All the designs studied were found compatible with AAS detection giving comparable sensitivity (between 0.38 and 0.47 s ng^{-1} As) and detection limit (around 0.2 ng ml^{-1} As) under optimum atomization conditions. However, significant differences in optimum conditions were found among the designs in terms of the applied voltage that strongly depends on the style of electrode attachment and electrode distance. The design with metal strip electrodes glued to a quartz body requires more than 14 kV to be operated. The design with sputtered electrodes of the same shape can reach the same sensitivity with 8.5 kV. These values can be further reduced to 6.5 kV, when decreasing the electrode distance from 3 to 1 mm. Selected DBD designs tested have been proven to be compatible with other spectrometric detectors such as AFS reaching detection limit 0.05 ng ml^{-1} As or AES with detection limit of 30 ng ml^{-1} As showing the universality of the planar DBD designs and its potential to further applications as well as mechanistic studies.

Keywords:
Dielectric barrier discharge; arsenic hydride; hydride generation atomic absorption spectrometry; atomic fluorescence spectrometry; atomic emission spectrometry