Abstract

Atomization conditions for selenium and lead hydrides in a dielectric barrier discharge (DBD) plasma atomizer with detection by atomic absorption spectrometry (AAS) were investigated in this work. Two designs of DBD atomizers were studied, the first one with glued electrodes and the second one with sputtered electrodes. The main experimental parameters were optimized, including supplied power and discharge gas (argon) flow rate. Additionally, the effect of several dryers was studied. Analytical figures of merit were determined for both plasma atomizers under the optimized conditions and compared to multiatomizer (MMQTA) as the most common hydride atomizer.

The optimum flow rate for selenium determination was 75 cm^3 min^{-1} Ar for both DBD atomizer designs as well as for MMQTA. In case of lead hydride atomization, ideal flow rate of argon was 175 cm^3 min^{-1} for DBD atomizer with glued electrodes and 150 cm^3 min^{-1} with DBD atomizer with sputtered electrodes, while MMQTA required only 100 cm^3 min^{-1}Ar. The optimal power supply for DBD with sputtered electrodes was found significantly lower at 7.3 W for selenium and 13.3 W for lead. A dryer based on nafion membrane was found as the most effective for both analytes studied. Its efficacy was verified by optical emission spectrometry.

As for analytical performance, it was discovered that sensitivity and the detection limits in MMQTA and DBD atomizers are very similar to each other for selenium determination. On the contrary, these attributes were different for MMQTA and DBD atomizers in case of lead.

Keywords:
atomic absorption spectrometry, hydride generation, hydride atomization, dielectric barrier discharge atomizer (DBD)