Abstract

The aim of this diploma thesis was to optimize the atomization conditions of two hydride forming elements - bismuth and tellurium in dielectric barrier discharge (DBD) plasma atomizers using atomic absorption spectrometry (AAS) as a detector. Two types of electrode constructions of planar DBD atomizers were studied: glued and sputtered electrodes while two construction of high voltage power supply sources were investigated employing either a sinusoidal or square wave modulation of high voltage function. The effect of the gas phase dryer included in the apparatus upstream the atomizer was also investigated. A nafion membrane tube dryer was identified as the most effective one. Its efficiency was verified using optical emission spectrometry. With the nafion tube included in the apparatus, two main parameters of DBD atomizers were optimized: the voltage of the power supply source and argon flow rate, which served as a discharge gas. Using optimal conditions, analytical characteristics were determined for all atomizers used and these were subsequently compared with those achieved in an externally heated quartz (multi)atomizer (MM)QTA.

In the case of bismuth, the optimal argon flow rate was determined to be 75 cm^3 min^{-1} for all atomizers. The optimal value for the power supply source with sinusoidal voltage modulation was 17.5 kV for the DBD atomizer with glued electrodes and 12.4 kV, respectively, for the atomizer with sputtered electrodes. It was 6.5 kV for a power supply source with rectangular modulation in combination with a DBD atomizer with sputtered electrodes. The optimal atomization conditions for tellurium determination were identical as those for bismuth determination, but the exceptions were: optimal argon flow rate for MMQTA was 50 cm^3 min^{-1} and optimal rectangular voltage applied was found to be 7 kV.

According to analytical characteristics obtained for tellurium determination it was clear that the sensitivity and detection limits for DBD atomizers and MMQTA are comparable, while in the case of bismuth determination DBD atomizers were found to provide significantly worse values of sensitivity and detection limits than QTA.

Keywords:
atomic absorption spectrometry, tellurium, bismuth, hydride generation, dielectric barrier discharge (DBD) plasma atomizer, atomization of volatile compounds