Abstract

This master's thesis deals with optimization of conditions of chemical hydride generation of tellurium and conditions of its atomization, specifically in three types of atomizers – in a diffusion flame (DF), in a heated multiple microflame quartz tube atomizer (MMQTA) and in a dielectric barrier discharge (DBD) atomizer. Tellurium hydride was generated in a flow injection arrangement and a high-resolution continuum source atomic absorption spectrometer was used for detection. As hydride generation can be only done from tetravalent species of tellurium, at first a simple procedure of pre-reduction of hexavalent species of tellurium by heating a standard in hydrochloric acid at 6 mol dm^{-3} was verified. Further, conditions of chemical generation were optimized with a goal to achieve as high generation efficiency as possible, namely, concentration of hydrochloric acid and sodium tetrahydroborate, volume of the reaction coil and a flow rate of carrier gas. Subsequently, conditions of atomization of tellurium hydride were examined with chosen optimal generation conditions. In the case of DF, it was an amount of hydrogen in the flame, a total flow rate of gases and observation height. In the case of MMQTA, temperature of the atomizer, a flow rate of carrier gas and a flow rate of air or oxygen needed for effective formation of hydrogen radicals inside the optical tube were optimized. For the DBD atomizer, main parameters were a power of the DBD and a flow rate of carrier gas. The effect of using various plasma gases on atomization in the DBD was investigated, as well as a feasibility of pre-concentration of tellurium hydride directly in the atomizer by means of oxygen introduced through a capillary was tested. Finally, basic analytical characteristics were determined for a direct transfer mode – limit of detection (LOD), limit of quantification and repeatability. The lowest LOD was achieved with the MMQTA that reached 17 and 34 ng dm^{-3} for two tested pieces of the MMQTA. The LOD of 55 ng dm^{-3} was determined for the DBD and the least sensitive atomizer was the DF with LOD equal to 690 ng dm^{-3}. Very good repeatability was obtained with all types of the atomizers, in the range from 2,3% to 3,5%.

Key word: chemical hydride generation, tellurium, atomic absorption spectrometry