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Developing methodology for atomic absorption determination of metallic elements in natural water

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Water is an integral part of the environment, a participant of the most important processes in living organisms - photosynthesis and metabolism, as well as the environment and at the same time a reagent for many technological and chemical processes. Therefore, the quality of drinking water and the one used in manufacturing processes requires strict control. Currently Ukraine has the regulatory guidance document (RD 52.24.347-95), which regulates the use of atomic absorption spectroscopy with electrothermal atomization (ETAAS) for the determination of metallic elements in natural water. It is known that the sensitivity of the method is sufficient for direct ETAAS determination of these elements, but the process of atomization is significantly affected by salt composition of natural water, which reduces accuracy of determination. Therefore, to develop reliable methods it is critical to study multicomponent systems that mimic various kinds of natural objects. In this paper, we explore how macrocomponent composition of natural waters impact atomization of chromium (Cr III, VI), lead (Pb) and aluminium (Al). The experiments have been performed using 'Saturn 3' spectrophotometer (Severodonetsk, Ukraine). Determination has been performed according to the single-beam scheme with deuterium background compensation. It's been shown that the ascorbic acid is the optimal chemical modifier for electrothermal determination of aluminium and lead, as well as potassium chloride is the one for chromium. The optimal concentration of modifiers has been determined as follows: 0.001 mol per liter for ascorbic acid (when determining lead and aluminium) and 0.2 mol per liter for potassium chloride (when determining chromium). Using obtained results, we have developed electrothermal atomic absorption techniques for determination of aluminium, chromium (III, VI), and lead in natural waters with various salinity. Metrological characteristics of the methodology have been tested on both model solutions and real samples of natural and drinking waters. The accuracy was evaluated by determining the recovery and by standard addition method. It's been proved that the trueness and precision of methodology is sufficient for analysis at the maximum permission level concentration.

Atomic absorption spectrometry, trace elements

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