SIMPLE AND FAST DETERMINATION OF LEAD IN ENVIRONMENTAL WATER SAMPLES CONTAINING HIGH CONCENTRATIONS OF SURFACE ACTIVE AND HUMIC SUBSTANCES

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Lead is one of the most toxic heavy metals with major interest in environmental safety. Even small amounts of lead that enter the environment should be controlled as they result in a cumulative effect. Lead and lead compounds are particularly toxic for children, but also cause health problem in adults such as neurotoxicity, nephrotoxicity and carcinogenicity. Due to the fact that lead is a very toxic element and it is simultaneously introduced into the environment from a variety of human activities there is an urgent demand for procedures of trace lead determination in environmental samples.

Electrochemical stripping analysis is generally recognized as one of the most suitable methods for trace metal determination. The analytical advantages of the stripping voltammetric techniques include excellent sensitivity with a large useful linear concentration, rapid analysis times and low cost. These methods have also a weakness - the measurement can be disturbed by the organic compounds, such as surface active substances, which can foul and passive the electrode causing a decrease or total decay of the analytical signal. Therefore the development of voltammetric procedures with elimination of interferences caused by organic compounds is desirable prior to the striping analysis of natural samples.

The purpose of the work was the selection of the optimal conditions for ultra trace determination of lead in the environmental water samples containing high concentrations of synthetic surface active substances and humic substances. In the proposed procedure of lead determination an anodic stripping voltammetry method is exploited, and Amberlite XAD resin was added directly to voltammetric cell. In such measurements the organic substances are removed by adsorption on the resin while lead is accumulated on the electrode by its reduction to the metallic form and, as was proved, it doesn’t adsorb on the resin.

This work has been optimized by a selection of optimal conditions, such as selection of the supporting electrolyte, mass of resin, time of mixing with resin, accumulation potential and time. The optimized conditions include: 0.1 mol L^{-1} acetic acid, 0.5 g of resin for 10 mL of solution, mixing time with resin 5 min, accumulation potential −0.55 V, accumulation time 30 s. Efficiency of organic substances removal by the addition of resin was precisely examined. The obtained results indicate that the addition of resin drastically eliminates the unwanted negative influence of the nonionic, anionic and cationic surfactants on lead peak height. In the presence of Amberlite XAD-7 resin inherency of even 20 mg L^{-1} of anionic and cationic surfactants and 15 mg L^{-1} of nonionic surfactant does not affect the lead signal at all. The effect of fulvic acids (FA) and humic acids (HA) as representative humic substances was investigated and it was found that 20 mg L^{-1} of FA and 5 mg L^{-1} of HA do not disturb the Pb(II) analytical signal, whereas 10 mg L^{-1} of HA decreases it to 40 % of the initial value. The typical range of dissolved organic carbon in natural waters is from 2 - 10 mg L^{-1}.

KEYWORDS: lead (II), determination, surfactants, humic substances