

Cheap in situ voltammetric copper determination from freshwater samples

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Abstract. Detection of low concentrations of heavy metals in environmental samples is of particular interest because most of them represent persistent, highly toxic pollutants. Cu²⁺ detection in environmental samples is important because it is typical heavy metal, being an essential element for human beings but at higher concentrations it can create health risks. Due to the accumulation steps involved, anodic stripping voltammetry (ASV) is one of the most sensitive techniques used for the detection of low concentrations of metal ions from different environmental samples. In order to minimize sample loss during sample collection, storage and transportation it is of particular interest to perform in situ rapid and reliable routine analysis. In the present paper we describe the use of a simple, disposable pencil graphite electrode (PGE) for the determination of Cu from river water samples by mercury film anodic stripping voltammetry. The investigated water samples were collected during a period of 3 years (2009-2011), from six sampling points situated along the lower part of the Prut River (Romania). ASV measurements were performed in the presence of Hg²⁺ in 0.1 M HNO₃ at a carbon pencil graphite working electrode. Standard addition method was applied for the quantification of Cu²⁺. The Cu²⁺ content of the most river water samples analysed exceeded 2 µg/L (MEWM, 2006), the maximum admitted concentration for surface waters, and these could be due to the anthropogenic activities in the region (e.g. the largest steel factory in Romania is located in the vicinity of the sampling area). Samples show an additional importance as the region is included in a protected area, Lower Prut Floodplain Natural Park, and trace elements transfer along the aquatic food chain has been previously documented (Matache et. al, 2012). The results obtained by ASV on PGE agreed well with those obtained by inductively coupled plasma atomic emission spectrometry (ICP-AES) using the Romanian standard SR ISO 11885-09. The sensor used in this work has shown some important advantages such being cheap, sensitive and able to generate reproducible results using a simple and direct electrochemical protocol. By using this type of disposable working electrodes and a portable electrochemical analysis system the developed method can be applied to the determination of copper ions directly at the sampling point.

Key words: copper, voltammetric determination, freshwater, in situ

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