

ELECTRODE AND METHOD FOR FAST ELECTROCHEMICAL DETECTION OF ARSENIC(III) FROM AQUEOUS SOLUTIONS

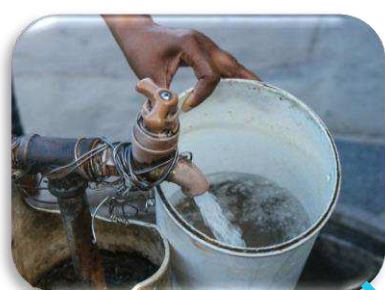
Florica MANEA*, Aniela POP, Anamaria BACIU, Adriana REMEȘ

Politehnica University of Timisoara, Romania, <https://www.upt.ro>

*e-mail: floricamanea@upt.ro

Patent no RO 129026 B1, released on 30.10.2020

The invention refers to the elaboration of a n electrode and a method for the electrochemical detection of arsenic (III), known as a very toxic pollutant, from aqueous solutions. Also, the working electrode (WE) and the procedure can be applied both for the detection of other pollutants from water (e.g., heavy metals, organic pollutants) and for other applications (e.g., pharmaceutical analysis, food quality control and safety, clinical analysis). The problem solved through this patent consists on the elaboration of a product and a process based on an electrochemical procedure for fast detection of arsenic (III) from aqueous solutions using an electrode made from relatively inexpensive materials, viable and exhibiting high electroanalytical performances as limit of detection, sensitivity, reproducibility, accuracy.



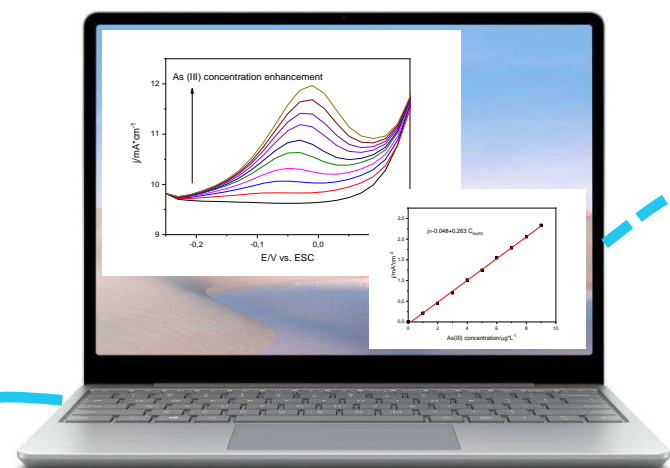
Environmental



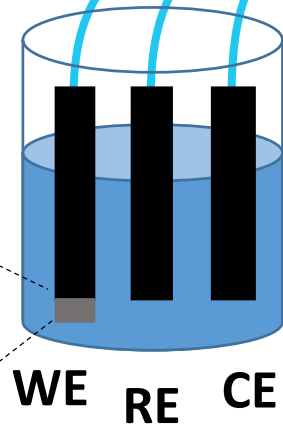
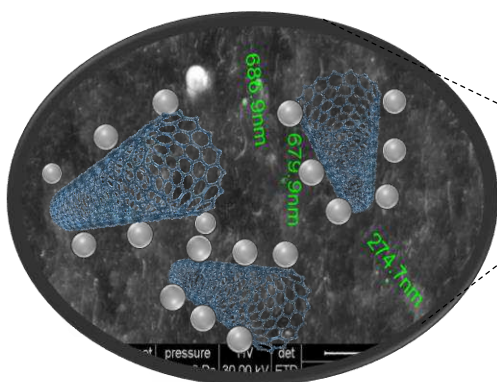
Food



Clinical



**Electrode composition
(CNF/Ag)**



Square-wave voltammetry procedure

Step I. Cathodic reduction: $As^{3+} + 3e^- \rightarrow As^0$

working conditions: - applied potential: -0.4 V/SCE

- time: 120 seconds

Step II. Anodic stripping: $As^0 \rightarrow As^{3+} + 3e^-$

provides the electrochemical response corresponding to the detection of arsenic (III) at the potential of -0.01 V / ESC by square wave voltammetry application.

Electrochemical depozition

$E = -0.4 \text{ V/SCE}$

$t = 60 \text{ s}$

+ $Ag(NO_3)$

- The electrode and the procedure of fast arsenic (III) electrochemical detection from aqueous solutions according to the invention consists on using an electrode, called working electrode (WE), in an assembly together with a counter electrode (CE) and a reference electrode (RE), and based on the anodic stripping method and by applying the square wave voltammetry technique in the presence of a supporting electrolyte for the detection of arsenic (III) from a contaminated water through the electrochemical response of the working electrode in the presence of the target pollutant. The WE is a composite electrode obtained by carbon nanofibers dispersion in an epoxy matrix, followed by the electrochemical modification of the electrode surface with silver particles.
- The process and the electrode for rapid electrochemical detection of arsenic (III) in aqueous solutions according to the invention have the following advantages: very high electroanalytical performances (*i.e.*, limit of detection, sensitivity, reproducibility, accuracy), low costs of materials used for the working electrode construction, long life use (at least 1 year).
- This method allowed determining As(III) concentrations of 5 ppb, 45 ppb and 105 ppb in three groundwater sources from west side of Romania.