ItalSens Carbon Screen Printed electrodes IS-HM

1 Description

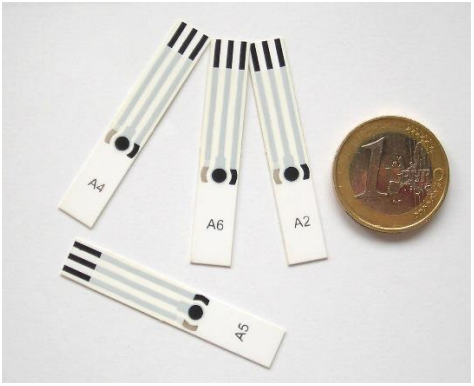

Figure 1 ItalSens IS-HM cut into single units

The three-electrode electrochemical cell has a graphite ink-based working electrode covered with a polymer containing mercury ions. Each electrode is produced by screen-printing technology followed by drop casting of the polymer and constitutes a circular graphite working electrode (3 mm diameter), a silver pseudo-reference electrode, and a graphite counter electrode.

The electrodes are delivered as strips of 20 pieces, which need to be manually cut.

Before using the electrodes for heavy metal detection, the mercury ions are converted into a mercury thin film. Afterward, the heavy metals are detected by anodic stripping voltammetry (ASV). Typical metals that are detected with these electrodes are zinc, cadmium, lead, and copper.

Details on how to perform the heavy metal quantifications are available on our website.

1.1 Application Advice

The silver pseudo-reference electrode shows higher stability in the presence of chloride ions. Hence, it is recommended that measurements are carried out in solutions with a chloride ion concentration of at least 10 mM.
The recommended medium solution for the analysis is hydrochloric acid (HCl), and it is suggested to always work in acidic conditions. The use of nitric acid (HNO_3) or other oxidizing acids is not advised as these may inactivate the film present on the working electrode. All measurements must be carried out under stirring conditions.

2 Technical Specifications

Dimensions: 0.8 x 4.5 cm
Working electrode dimensions: 7.06 mm^2
Substrate: Polyester
Thickness: 200 µm
Contact pad pitch: 2.54 mm
Coefficient of Variation (CV) (n = 10) calculated on lead detection (Pb): 3 %

3 Measurements

3.1 Pre-Conditioning

Example of repeated SWV in 20 mM HCl (E cond -180 mV, t cond 30 s, t equilibration 10 s, Amplitude 25 mV, Frequency 15 Hz)

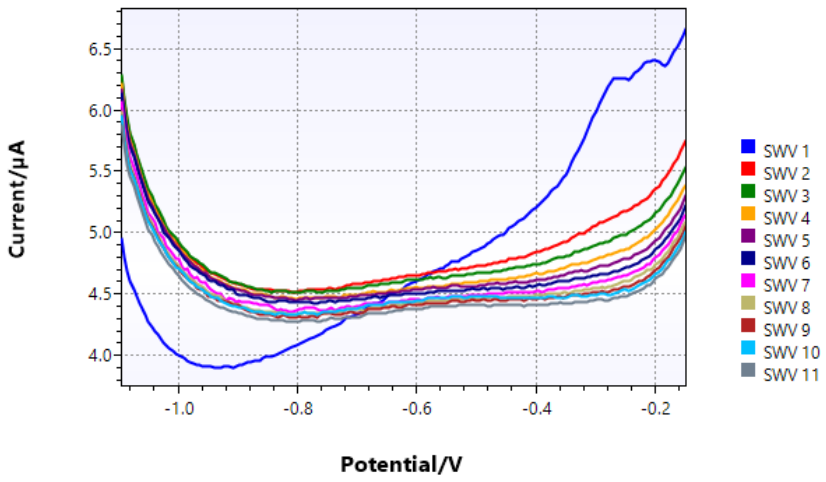

Figure 2 SWV, IS-HM, pre-conditioning

3.2 Detection of Cd, Pb, and Cu

Recorded curves for Cd, Pb, and Cu (E cond -120 mV, t cond 45 s, E dep -1.15 V, t dep 120 s, t equilibration 10 s, Amplitude 25 mV, Frequency 25 Hz)

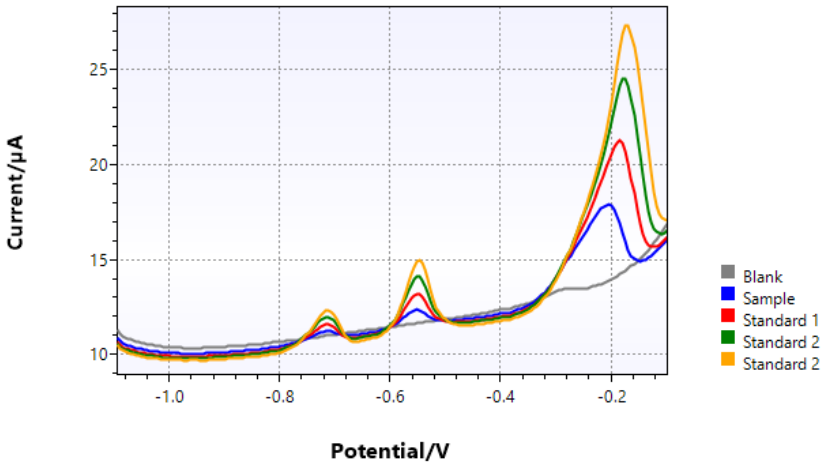

Figure 3 stripping SWV of increasing metal ion concentrations

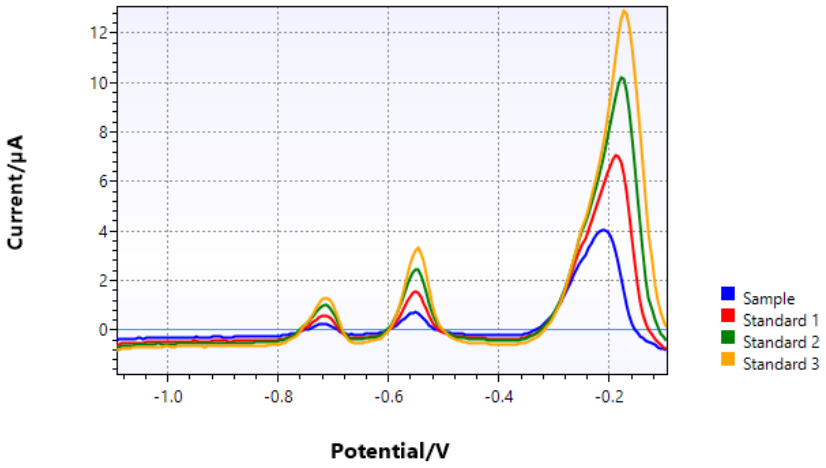

Figure 4 after subtracting the baseline from the curves in Figure 3

4 Application Examples from Peer-Reviewed Publications

4.1 Sensor for Heavy metal detection

- I. Palchetti, A. Cagnini, M. Mascini, A.P.F. Turner, "Characterisation of screen-printed electrodes for detection of heavy metals ", Mikrochimica Acta, 131, n. 1-2, 1999, 65-73. https://doi.org/10.1007/s006040050010
- I. Palchetti, C. Upjohn, A.P.F. Turner, M. Mascini, "Disposable screen-printed electrodes (SPE) mercury-free for the lead detection", Analytical Letters, 33, 7, 1231-1246, 2000 https://doi.org/10.1080/00032710008543119
- I. Palchetti, G. Marrazza, M. Mascini, "New procedures to obtain electrochemical sensors for heavy metal detection", Analytical Letters, 34 (6) 2001. https://doi.org/10.1081/AL-100103594
- I. Palchetti, A. Kicela, S. Majid, G. Marrazza, M. Mascini, "Polymer-mercury coated screen-printed sensors for electrochemical stripping analysis of heavy metals", Int. Journal of Environmental Analytical Chemistry, accepted 2002. https://doi.org/10.1080/0306731021000049617