

18th Meeting of the Portuguese Electrochemical Society



Sociedade Portuguesa de Electroquímica

25th-27th March 2013

Porto, Portugal

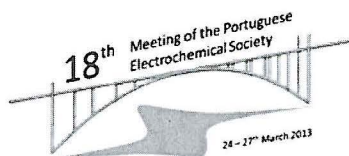
18th Meeting of the Portuguese Electrochemical Society

Sociedade Portuguesa de Electroquímica



*Departamento de Química e Bioquímica
Faculdade de Ciências da Universidade do Porto
Porto
Portugal*

25-27th March 2013



Title

18th Meeting of the Portuguese Electrochemical Society

Coordination

Aquiles Araújo Barros
Beatriz Quinaz
Daniel Oliveira Carvalho
Diana Fernandes
Inês Maria Valente
José António Rodrigues
Luísa Martins
Luís Ferreira Guido
Luís Moreira Gonçalves
Manuela Maria Moreira
Maria Isabel Rocha
Paulo Joaquim Almeida
Rui Miguel Ramos

Printing

CopyPage
Rua Quinta dos Orfãos
Bloco A2, Loja 9
4710-453 Braga, Portugal

Edition

Sociedade Portuguesa de Electroquímica
180 copies

Date

March of 2013

ISBN

978-989-95527-1-5

OC11.	A new class of Pd alloy catalysts for methanol and ethanol electro-oxidation in alkaline media	43
OC12.	Spectroelectrochemical evidence of redox transitions in ultra thin MnO ₂ electrodes in a new protic ionic liquid	44
OC13.	Variable-temperature voltammetry to gain molecular insights into electron transfer processes based on the asymmetric Marcus-Hush model	45
OC14.	Optimization of bioelectricity generation by <i>Geobacter sulfurreducens</i> in microbial fuel cell	46
OC15.	Nickel foam supported MnO ₂ nanosheet arrays for electrochemical energy storage	47
OC16.	LiFePO ₄ cathode material for Li-ion batteries modified with conductive polymer PPy/PEG	48
OC17.	EIS study of amine cured epoxy-silica-zirconia sol-gel coatings for corrosion protection of the aluminium alloy EN AW 6063	49
OC18.	Electrochemical system for assessing hybrid coatings for corrosion protection of hot dip galvanized steel in concrete	50
OC19.	Cathodic polarization of 316L stainless steel under static and dynamic conditions	51
OC20.	Characterization of hybrid sol-gel coatings applied over tinplate	52
OC21.	Effect of combined electrocoagulation/anodic oxidation processes on the biodegradability of sanitary landfill leachates	53
OC22.	Electrocrystallisation of organic metals under magnetic field	54
OC23.	Chemical and electrochemical characterization of reduced graphene oxide-coated polyester fabrics	55
Poster communications		57
P1.	Determination of lead migration from toys by anodic stripping voltammetry using a bismuth film electrode	59
P2.	Analysis of single-cultivar extra virgin olive oil using cyclic voltammetry	60
P3.	Discrimination of monofloral honeys using a potentiometric electronic tongue	61
P4.	Simultaneous determination of dopamine and ascorbic acid using an amorphous carbon nitride electrode – A comparison with a boron-doped diamond electrode	62
P5.	Voltammetric determination of insecticide thiacloprid with a multi-walled carbon nanotubes/glassy carbon electrode	63
P6.	Indomethacin and acemethacin detection using microelectrodes	64
P7.	Impedance Measurement Uncertainties in Impedance Spectroscopy	65
P8.	A disposable impedimetric biosensor for flow injection lectin affinity chromatography	66
P9.	Towards rapid and inexpensive detection of GMO specific events: Electrochemical genosensors on disposable Au electrodes	67
P10.	Monitoring of Cr, Fe and Zn contents during the application of electrochemical processes to treat sanitary landfill leachates	68

P2. Analysis of single-cultivar extra virgin olive oil using cyclic voltammetry

Andreia Fernandes^a, Luís G. Dias^a, José A. Pereira^a, Ana C.A. Veloso^{b,c} and António M. Peres^{a,d}

^aCIMO – ESA, Instituto Politécnico de Bragança, Bragança, Portugal, ^bDEQB-ISEC, Instituto Politécnico de Coimbra, Coimbra, Portugal, ^cIBB–CEB, University of Minho, Braga, Portugal, ^dLSRE – ESA, Instituto Politécnico de Bragança, Bragança, Portugal

*peres@ipb.pt

Extra virgin olive oils (EVOO) quality evaluation is a complex task. The development of fast, simple and low-cost electrochemical methods to assess the quality of high-valued EVOOs, namely of “single-cultivar” EVOOs, which are very appreciated by consumers, is still a challenge task. Few works can be found in the literature regarding the application of sensor devices for classifying “single-cultivar” EVOOs according to the olive cultivar, in order to guarantee their authenticity. Cimato et al. [1] used the signals recorded with an electronic nose to separate among clusters of 12 different single-cultivar EVOOs. Apetrei et al. [2] showed that combining the electrochemical signal data obtained from electronic eye, nose and tongue allowed a good predictive classification capacity according to the olive variety of three single-cultivar EVOOs, with different degree of bitterness. In this work an approach based on cyclic voltammetry (CV) is proposed to analyze 4 different single-cultivar EVOOs (1 Portuguese (pt) and 3 Spanish (es) cultivars): Cobrançosa (C-pt), Manzanilla (M-es), Frantoto (F-es) and Redondilha (R-es). For each EVOO sample, 3 extractions were performed using a solution of ethanol/water (EtOH/H₂O 1:4; v:v). The CV technique has been evaluated using an Ag/AgCl double-junction reference electrode (M90-02, Orion) and two pairs of counter/working electrodes: (i) platinum (M241Pt, Radiometer) and silver (M295Ag, Radiometer) electrodes or (ii) two platinum (M241Pt and M21, Radiometer) electrodes. The resultant currents of the potentiostat-galvanostat device (PG580, Uniscan) have been acquired between -1.5 to +0.8 V (Pt/Ag) or -2 to +2V (Pt/Pt), at a potential scan rate of 100 mV/s (UiEChem v.1.34 software, Unisann Instruments Ltd) and considered for data analysis. The preliminary results, allow expecting that, the differences of shape and position of the peaks from the CV, observed from one extract to another, can be used to differentiate between single-cultivar EVOOs, according to cultivar and/or geographical origin.

[1] A Cimato, DD Monaco, C Distante, M Epifani, P Siciliano, AM Taurino, M Zuppa, G Sani, *Sensors Actuators B*, 2006, 114, 674–680.

[2] C Apetrei, IM Apetrei, S Villanueva, JA de Saja, F Gutierrez-Rosales, ML Rodriguez-Mendez, *Analytica Chimica Acta*, 2010, 663, 91–97.



ANALYSIS OF SINGLE-CULTIVAR EXTRA VIRGIN OLIVE OIL USING CYCLIC VOLTAMMETRY

Andreia Fernandes^a, Luís G. Dias^a, José A. Pereira^a, Ana C.A. Veloso^{b,c} and António M. Peres^{a,d*}

^aCIMO - Escola Superior Agrária, Instituto Politécnico de Bragança, Portugal

^bDEQB-ISEC - Instituto Politécnico de Coimbra, Coimbra, Portugal

^cIBB-CEB - University of Minho, Braga, Portugal

^dLSRE-ESA - Instituto Politécnico de Bragança, Portugal

*) peres@ipb.pt

INTRODUCTION

EVOOs - Extra virgin olive oils

Quality evaluation is a complex task and carried out qualitatively by experienced olive oil tasters

Important to develop fast, simple and low-cost electrochemical methods to assess the quality of high-valued EVOOs

OBJECTIVE

Cyclic Voltammetry (CV) for quality evaluation

Application to "single-cultivar" EVOOs analysis

SAMPLES

4 Single-cultivar EVOOs

1 PORTUGUESE (pt) cultivar: Cobrançosa (C-pt)

3 SPANISH (es) cultivars: Manzanilla (M-es), Frantoto (F-es), Redondilha (R-es)

EXPERIMENTAL PROCEDURE

EVOO SAMPLE TREATMENT

3 extractions using EtOH/H₂O 1:4 (v:v)
(5 mL EVOO + 100 mL EtOH/H₂O mixture)

CV ANALYSIS

2 mL of the final extract → phenolic compounds
10× Dilution with 0.1 M TBAP in acetonitrile

No drying step
No re-dissolving step

CV EQUIPMENT

Potentiostat-Galvanostat device

Ag/AgCl reference electrode (M90-02)

+

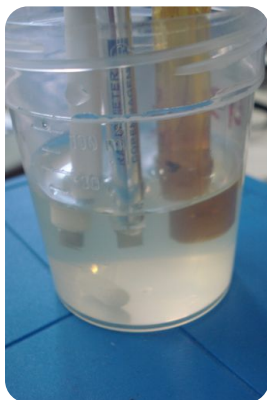
Two sets of electrodes:

1 – Platinum (M241Pt) – Counter electrode
Silver (M295Ag) – Working electrode

CONDITIONS: -1.5 to +0.8 V, 100 mV/s

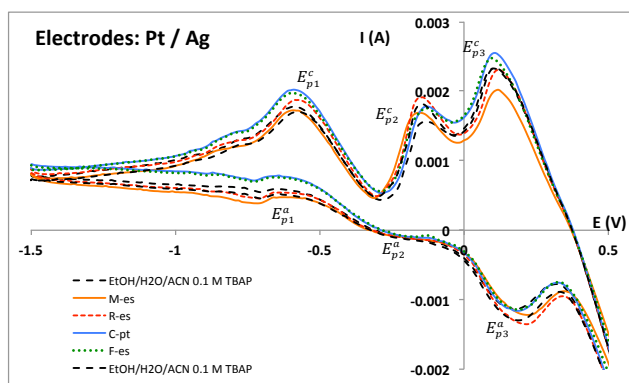
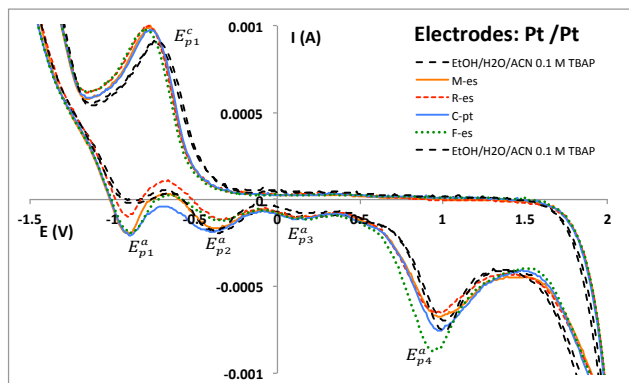
2 – Platinum (M241Pt) – Counter-electrode
Platinum (M21Pt) – Working electrode

CONDITIONS: -2 to +2 V, 100 mV/s



PRELIMINARY RESULTS

Electrochemical response of the phenolic fraction extracted from the 4 single-cultivar EVOOs



- ✓ Set Pt-Ag electrodes:
 - 3 oxidation and 3 smaller back reduction peaks can be identified
 - current peaks (E_p^a and E_p^c) vary slightly with the type of cultivar
- ✓ Set Pt-Pt electrodes:
 - 4 small oxidation peaks and 1 back reduction peak
 - E_p^a and E_p^c values change with the type of cultivar
 - More clear differentiation among single-cultivar EVOOs

CONCLUSIONS

The differences of shape and position of the peaks from the CV may be used to differentiate single-cultivar EVOOs according to:

- cultivar
- geographical origin

