

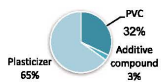
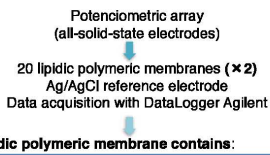
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INTRODUCTION

- ✓ Detection of olive oils' geographical origin is a challenging and hard task.
- ✓ Improved classification of olive oils may be achieved by combining electrochemical fingerprints with multivariate statistical techniques.
- ✓ In this work, an electronic tongue, with 40 sensing units containing lipid sensor membranes, was used together with linear discriminant analysis to classify Tunisian olive oils according to the geographical origin.

ELECTRONIC TONGUE (E-tongue)



Additive compound

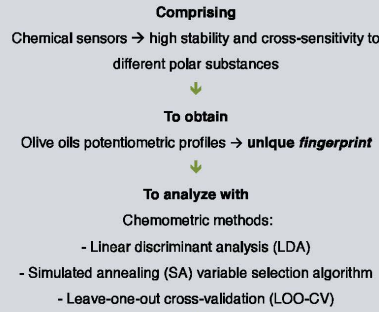
- [1] Octadecylamine
- [2] Oleyl alcohol
- [3] Methyltriethylammonium chloride
- [4] Oleic acid

Plasticizer

- [A] Bis(1-butylpenyl) adipate
- [B] Dibutyl sebacate
- [C] 2-Nitrophenyl-octylether
- [D] (2-ethylhexyl)phosphate
- [E] Dioctyl phenylphosphonate

AIMS

ELECTRONIC TONGUE



To achieve
 Best olive oil's classification according to the geographical origin for a repeated K-fold-CV (10 repeats; 4 folds → ensuring that 25% of the original data is left for internal validation purposes)



CULTIVARS (samples x 2)

- Chemlali (17):**
 Kairouan (8), Sidi Bouzid (2) and Stax (7)
Sahli (13):
 Mahdia (5), Sousse (6) and Kairouan (2)

RESULTS

Establishment of the best E-tongue-LDA-SA models:

- Sub-set sensors selection using a variable selection simulated annealing (SA) algorithm
- Sub-set with minimum number of sensors → maximum correct classification, LOO-CV
- Internal-validation: repeated K-fold-CV

Olive oils' discrimination according to geographical origin

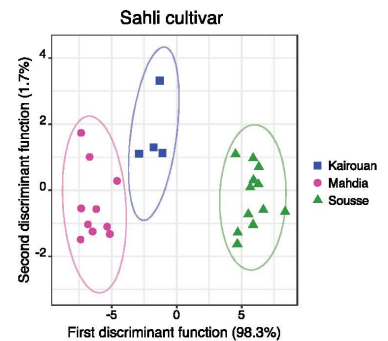
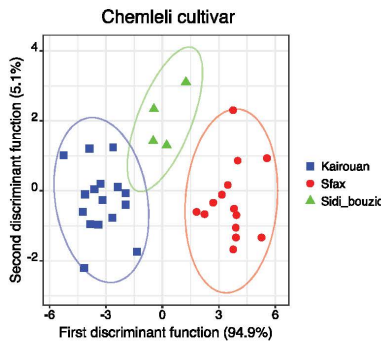
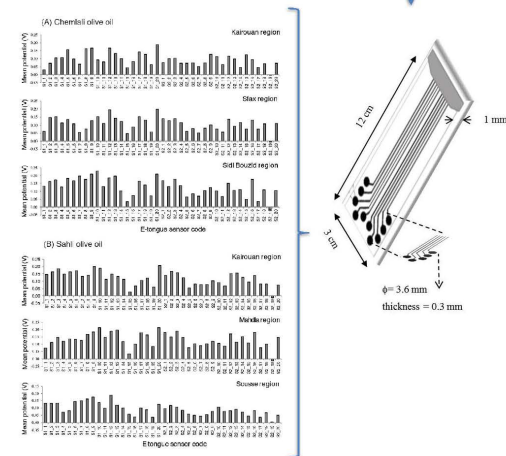
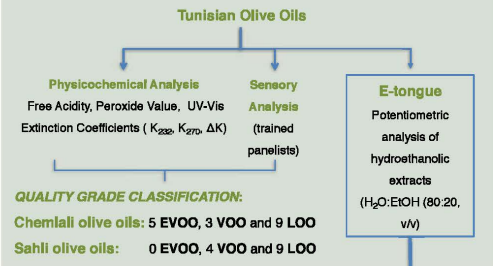
i) For Chemlali cultivar

- E-tongue-LDA-SA model: 12 sensor signals
- 100% for original grouped data (FIGURE 2)
- 94% of correct classifications for LOO-CV
- 92 ± 7% (from 78% to 100%) for repeated K-fold-CV
- Selected sensors: "S1:1" "S1:7" "S1:8" "S1:9" "S1:16"
 "S1:19" "S2:1" "S2:4" "S2:7" "S2:8"
 "S2:17" "S2:19"

ii) For Sahli cultivar

- E-tongue-LDA-SA model: 8 sensor signals
- 100% of original grouped data (FIGURE 3)
- 100% correct classifications for LOO-CV
- 97 ± 8% (from 71% to 100%) for repeated K-fold-CV
- Selected sensors: "S1:1" "S1:12" "S1:19" "S2:1"
 "S2:5" "S2:17" "S2:19" "S2:20"

Electronic Tongue Analysis



CONCLUSIONS

- The potentiometric E-tongue, coupled with the LDA-SA procedure, can be successfully applied as a practical tool to assess the geographical origin of Tunisian monovarietal olive oils (cvs Chemlali or Sahli), regardless their quality grade (i.e., EVOO, VOO or LOO) and even if they are produced in close regions under similar geographical and climatic conditions.
- Overall the achieved results confirmed the E-tongue potential for olive oil analysis, previously reported by our research group and others.

Acknowledgments

This work was financially supported by Project POCH-01-0145-FEDER-006984 - Associate Laboratory LSRE-LCM, Project UIDB/00106/2013 - CQ-VR, Project UIDB/04489/2013 - CEB and Project UIDB/00690/2013 - CIMO all funded by FEDER - Fundo Europeu de Desenvolvimento Regional through COMPETE2020 - Programa Operacional Competitividade e Internacionalização (POCI) - and by national funds through FCT - Fundação para a Ciência e a Tecnologia, Portugal.
 Nuno Rodrigues thanks FCT, POPH-OREN and FSE for the Ph.D. Grant (SFRH/BD/104038/2014).
 Souheib Oueslati is grateful for the support of the Tunisian Ministry of Agriculture.

