DISCRIMINATION OF THREE BACTERIA SPECIES USING A POTENTIOMETRIC ELECTRONIC TONGUE

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OBJECTIVES

Application of a potentiometric E-tongue (40 lipid polymeric sensor membranes with cross-sensitivity) to **discriminate:**

- 3 bacteria species (*Enterococcus faecalis* ATCC29212; *Staphylococcus aureus* ATCC29213 and *Escherichia coli* ATCC29998)
- 2 concentration levels (low and high levels assessed based on optical density values)

EXPERIMENTAL

Cultivation: Brain Heart Infusion (BHI) broth medium.

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Inoculation: the microorganisms were inoculated into the broth medium and grown at 90 rpm and 37 ºC overnight in a rotatory incubator (**Fig. 1**).

↓

Microorganisms growth: biomass level was spectrophotometrically assessed by measuring the optical density at 560 nm (**Fig. 2**). The final cultures harvested (centrifugation at 9000 rpm for 10 min), washed (same conditions) with distilled water, dried (30ºC overnight) and stored at -20 ºC.

↓

Rehydration: before E-tongue analysis, the cells were rehydrated with 20 mL of deionized water for 30 minutes at room temperature.

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E-tongue Analysis: each assay took 5 minutes, enabling the establishment of a pseudo-equilibrium between the samples and the sensors' membranes (**Table 1**), being the potentiometric profile signals recorded (**Fig. 3**). The working volume is 100 mL.

↓

Data Treatment: the classification performance of the E-tongue was evaluated using a linear discriminant analysis (LDA) coupled with the meta-heuristic simulated annealing (SA) variable selection algorithm.

RESULTS

An E-tongue-LDA-SA model, based on the potentiometric data of a sub-set of 15 non-redundant sensors (selected by the SA algorithm), allowed the correct classification of:

- ✓ **100%** of samples (**Fig. 4**, correlation)
- ✓ **85%** of samples (leave-one-out cross-validation)

according to the microorganism specie and concentration level.

CONCLUSIONS

The E-tongue could be successfully used as a preliminary tool for discriminating:

→ Bacteria species: *E. coli*, *E. faecalis* and *S. aureus*

→ Bacteria contents: high from low levels

in aqueous solutions

Fig.1. Incubator device

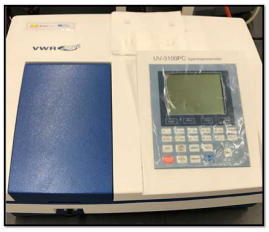

Fig.2. Spectrophotometer

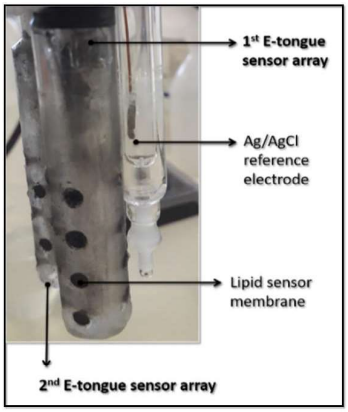

Fig.3. E-tongue device

Table 1. Membranes' composition

E-tongue sensors details (identification code; pairs of plasticizer additive compounds, used in the preparation of each lipid-polymeric membrane).

Sensor code		Plasticizer (~65%)	Additive (~3%)
1st array	2nd array		
S1:1	S2:1	2-Nitrophenyl-octyl ether	Octadecylamine
S1:2	S2:2		Oleyl alcohol
S1:3	S2:3		Methyltrioctylammonium chloride
S1:4	S2:4		Oleic acid
S1:5	S2:5	Tris(2-ethyl-hexyl) phosphate	Octadecylamine
S1:6	S2:6		Oleyl alcohol
S1:7	S2:7		Methyltrioctylammonium chloride
S1:8	S2:8		Oleic acid
S1:9	S2:9	Dibutyl sebacate	Octadecylamine
S1:10	S2:10		Oleyl alcohol
S1:11	S2:11		Methyltrioctylammonium chloride
S1:12	S2:12		Oleic acid
S1:13	S2:13	Bis(1-butylpentyl) adipate	Octadecylamine
S1:14	S2:14		Oleyl alcohol
S1:15	S2:15		Methyltrioctylammonium chloride
S1:16	S2:16		Oleic acid
S1:17	S2:17	Bis(2-ethylhexyl) phthalate	Octadecylamine
S1:18	S2:18		Methyltrioctylammonium chloride
S1:19	S2:19		Oleyl alcohol
S1:20	S2:20		Oleic acid

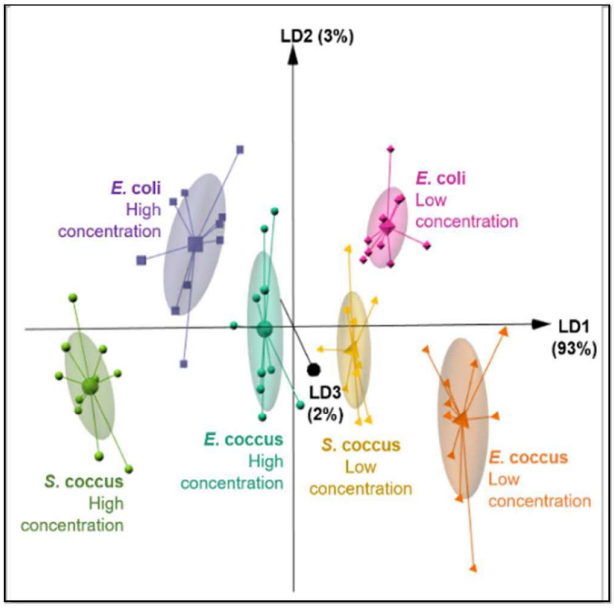

Fig.4. E-tongue-LDA-SA performance

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