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MÉTODOS DE ANÁLISE DE ALIMENTOS

Application of a lab-made electronic nose as a tool to assess extra virgin olive oil sensory category

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Premium extra virgin olive oils are usually subjected to national and international contests aiming to promote their competitiveness and internationalization capacity. Olive oils were assessed by a sensory expert panel and initially split according to the perceived intensity of the fruitiness sensation into four categories, namely ripe (RF), green delicate (GD), green medium (GM), and green robust (GR) fruitiness.[1] However, even for trained panelists, the assessment comprises a subjectivity degree, and the number of oils that can be evaluated per day is limited. In this sense, the use of electronic sensing devices can be helpful as pre-assessment tools, which may allow reducing the initial number of oils to be evaluated. Thus, a lab-made electronic nose (E-nose) comprising nine commercial metal oxide semiconductor (MOS) sensors, previously developed by the research team,[2] was applied (**Figure 1**) aiming to verify its suitability for this purpose. In total, 59 olive oils were included in this study, which were previously classified by an expert sensory panel in a national contest: 20 oils as RF, 15 as GD, 17 as GM and 7 as GR fruitiness. For the E-nose analysis, 0.5 mL of each olive oil was inserted into a 25 mL glass vial and placed in the sampling chamber at 28 ºC (temperature recommended by the International Olive Council for sensory analysis of olive oils) for 13-min, allowing to generate a volatile fraction representative of the sample. After a cleaning step of the sensors' surfaces using an air flow, the gas headspace from each sample was directed into the detection chamber, where it interacted with the MOS sensors for 2.5 min. The resistance signals of each of the nine MOS sensors were recorded by a data logger at 4-sec intervals being then treated taking into account seven distinct feature extraction methods: the last response point (LP), the integral of the response curve (INT), the maximum response point (MAX), the minimum response point (MIN), the sum of the response curve (SUM), and the mean of the response curve (MEAN).[3] The results showed that the E-nose feature extracted data could be used to satisfactorily discriminate, based on a linear discriminant analysis (LDA) coupled with a simulated annealing (SA) algorithm, the olive oils according to sensory category groups with a sensitivity of 100% for training (**Figure 2a**) and 73% for the leave-one-out cross-validation (LOO-CV) procedure. The lower sensitivity achieved for the internal validation was mainly due to misclassification between GD and GM. Indeed, the classification performance of the E-nose-LDA-SA could be enhanced if only three groups were considered: RF, GD+GM and GI fruitiness. In this case the E-nose could correctly classify 100% of the oils for training (**Figure 2b**) and 92% for LOO-CV. In conclusion, the E-nose could be effectively applied as a rapid, cost-effective, and non-invasive tool for olive oil sensory classification.

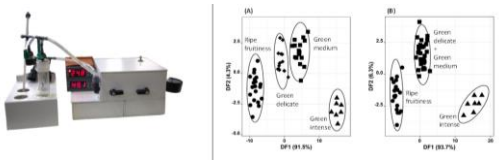

Figure 1 (Left): Electronic nose with nine metal oxide semiconductor (MOS) sensors used to analyze the olive oils. **Figure 2 (Right):** E-nose -LDA-SA model performance (training) regarding the supervised discrimination of EVOOs according to the sensory grade groups.

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