Objective

Quality control of food products must ensure conformity of product, in terms of safety, chemical composition and also from a sensory point of view (smell, taste). To guarantee an appropriate and constant flavor, manufacturers must test the organoleptic features of final products. Currently, food products are assessed by human sensory panels. However, this method is time-consuming and can be unpleasant. This poster will present how to develop an instrumental quality control with an Electronic Nose and an Electronic Tongue.

Electronic Sensing Instruments

Tests on odor, taste and vision attributes were conducted respectively with FOX electronic nose, ASTREE electronic tongue and IRIS electronic eye (Alpha MOS, France).

The FOX instrument analyzes the headspace of the samples. It includes eighteen Metal Oxide Sensors that react to volatile compounds (change of electrical resistance) and measure the global odor fingerprint of products. It is further equipped with a HS100 autosampler (CTC Analytics, Switzerland) to automate sample incubation and injection.

FOX Electronic Nose

The ASTREE electronic tongue analyzes organic and inorganic compounds dissolved in liquids that are responsible for taste. The detection principle is based on a potentiometric measurement with seven ChemFET (Chemical modified Field Effect Transistor) sensors.

ASTREE Electronic Tongue

Samples & Analytical Method

Eight samples of tomato sauce were analyzed with a sensor based Electronic Nose, the FOX, and the ASTREE Electronic Tongue in order to compare their taste and aroma profiles. The sample set included different qualities of tomato sauce: good / bad (too salty, too acid, aged).

Table 1: Samples

Sample designation	Qaulity assessed by the sensory panel
G1	Good
G2	Good
B3	Bad (too salty)
B4	Bad (too acid)
G5	Good
G6	Good
G7	Good
B8	Bad (aged)

Table 2: Analytical Conditions

FOX electronic nose parameters	
Sample mass	0.5 g
Incubation temperature	60°C
Incubation time	10 min
Carrier gas	Synthetic dry air
Injected volume	1mL
Syringe temperature	70°C
Acquisition time	120 s
ASTREE electronic tongue parameters	
Sample preparation	25 g of cheddar in 100mL of water at 55°C. Mixing of the solutions for 20s. Removal of the lipid layer before the analysis
Sample volume	25 mL
Acquisition time	120 s

Sensory Profiling Based on Aroma & Taste

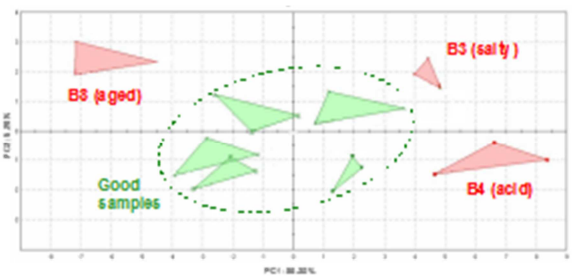

Fig. 1: Principal Component Analysis of combining E-Nose & E-Tongue Measurements

The measurements from the E-Nose and the E-Tongue were gathered in a single matrix and computed with dedicated software to build up a sensory map of tomato sauces (figure 1).

This Principal Component Analysis (PCA) shows a clear differentiation of tomato sauces based on their quality:

- good quality group (in green)
- bad samples (in red). They are separated from good ones and are also separated from one another, showing that the 3 defects are different.

Quality Control Model

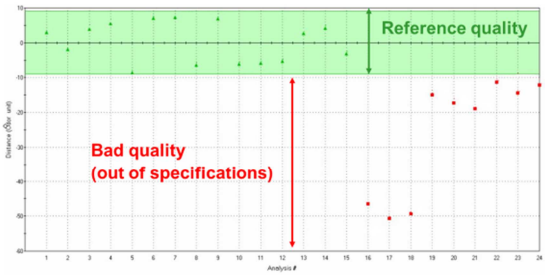

Fig. 2: Statistical Quality Control Model for Tomato Sauce Evaluation

For routine analysis purposes, a Quality Control Card can be set-up based on E-Nose measurement (fig. 2).

To establish the range of acceptable grade (green band), good samples were taken as the reference quality.

Bad sauces (in red) were plotted on this model: they fell outside this green band. Therefore, they are correctly recognized as out of specifications.

Conclusion

Electronic Nose and Tongue provide the ability to rapidly determine the quality of food ingredients and food products.
These analyzers are convenient decision tools to help companies optimize the time and costs of the analysis chain process.