Introduction

Plastics materials are used extensively in a wide variety of applications. One of the most important of these applications involves packaging materials. For example, plastics can be used in bottles containing soft drinks, in boxes containing food products, or in the packaging of raw materials during shipment. The analysis of off-odors in Polyethylene (PE) samples is very important toward detecting residual solvents as well as unexpected by-products resulting from the manufacturing process. Additionally, the use of anti-oxidants or light stabilization may induce off odors.

Alpha MOS Sensor Array System is specifically designed for the analysis, identification and recognition of complex odors, aromas and most volatile compounds.

The following investigations were conducted to determine the ability of the FOX Electronic Nose to identify off-odors in polymers for food applications, like PE (Polyethylene) and PET (Polyethylene terephthalate).

Two applications are described, the first one is to optimize the manufacturing process, and the second one discusses the qualities of off odors in PET bottles.

OPTIMIZATION OF THE MANUFACTURING PROCESS

Samples

PE pellets samples from different process were analyzed by both sensory panel and the FOX 4000 sensor array system coupled to an autosampler.

The sensory panel analysis consisted of soaking the pellets for 1 week in mineral water at 80°C.

Sensory panelists evaluated this water and gave their ranking on a scale from 0 to 7 (0- without odor and 7- very strong odor). The acceptability limit from the panel is 3.

Analytical conditions

- Quantity of sample : 1 g
- Heating temperature of the oven : 80°C
- headspace generation time : 15 minutes
- Volume injected : 2500µl
- Speed of injection : 2500µl
- Carrier gas flow rate : 300 ml/min
- Dry synthetic air

Data processing

Odormapping can be performed that shows that the different processes of samples have been clearly discriminated. Once it has been established (figure 1) that the level of discrimination is efficient, comparison of samples from different process is possible, in order to select and set up the best way to manufacture reference PE samples.

It is possible to launch a Q/C project for predicting sample quality using a statistical model in the FOX software.
QUALITY CONTROL OF PET BOTTLES

One of the most detrimental problem that can occur during the manufacturing of PET bottles is the presence of acetaldehyde, which can render the material unfit for use in packaging. The FOX system has been trained to determine the presence of acetaldehyde and to recognize the contaminated bottles during the production process.

Operating conditions & data processing

The bottles are grounded on nitrogen. The pieces were stored in vials for 5 minutes at 60 °C. The carrier gas flow rate was (300ml/min). The analyses were performed using bottles with three different concentration levels:

- 2 ppm (acceptable)
- 5 ppm (limit of acceptability)
- 8 and 15 ppm (rejected)

Classification of the various sample classes was assessed using principal component analysis. The different levels of contamination of each of the PET sample have easily been discriminated for the different classes. The good discrimination between each class of contaminated sample will afford the evaluator of the packaging the ability to directly assess the raw materials and determine the acceptability of the material for food packaging.

CONCLUSION

The sensor array system is a very useful quality control tool which can be used in an R&D laboratory to set up acceptable process criteria without producing off odors, as well as in quality control laboratories to monitor the raw materials and final product.

Other applications available:
- Permeability of packaging films
- Study of full bottles in dynamic mode with a special cap (PET).