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PETes AA Analyzer

Measuring Acetaldehyde in PET preforms

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A unique and innovative method for the measurement of Acetaldehyde in PET preforms

The determination of acetaldehyde (AA) content in PET preforms is a commonly known test to establish product quality and usability. The conventional analytical approach comprises two main steps: 1. sample preparation by cryogenic grinding of various sections of the preform and 2. gas chromatographic analysis by headspace technique. To obtain significant data any conventional instrument must be periodically calibrated using a reliable precise standard solution. To achieve this, the standard acetaldehyde solution must be first distilled and then titrated, so to produce a series of reference samples of different concentrations. Those will be utilized to generate a so called calibration graph. In this respect, the degree of repeatability of measured data in one laboratory is often not reproducible between such laboratory and another. There are several methods, more or less official, to measure AA and, as a result, one preform can produce different analysis data. Which is the correct and absolute real data? In theory, no one, as all are relative to the method utilized to measure the AA. Existing conventional laboratory equipment demand activities of treatment and handling of the preform sample to be analysed (manipulation, cutting etc.) that seriously influence accuracy and reproducibility of the result. Also, the "technical time" and associated cost involved in carrying out the test are such that only sporadic checks are performed.

The PETes method

With conventional methods AA levels are measured in a chemical laboratory using an analytical system generally composed of a static headspace sampler, in combination with a gas chromatograph. The sample is cryogenically ground, sifted and weighed, while the preparation of the reference acetaldehyde solution is carried out by laboratory personnel (titration, preparation of reference solutions, etc.).

During production, preforms are withdrawn and sent to the laboratory for AA analysis. The result of the analysis is available after a period which is not compatible with production times. The impossibility of having immediate analysis results may end up in the scrapping of large quantities of preforms. The use of the **PETes AA Analyzer** allows to increase the rate of monitoring of the PET preforms by reducing analysis times and costs. It produces highly reliable results as the preform is analysed as such, and allows to carry out the test in proximity to the injection moulding machine or anyway within the production plant, without having to use specialized laboratories.
The PETes AA Analyzer is based on a new fast head space gas chromatography technology. Five different automatic phases allow the measurements: washing, sample conditioning, pressurisation, load of the loop and GC analyses.

Figure 1 shows the general operating scheme of the PETes AA Analyzer.

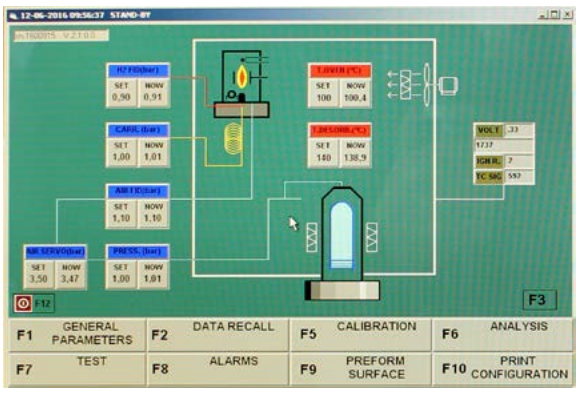


Figure 1

The calibration of the de-adsoprtion cell is performed in one single step. It could be done using a standard solution of AA in water or a calibrated gas.
An example of the calibration report is shown in figure 2.

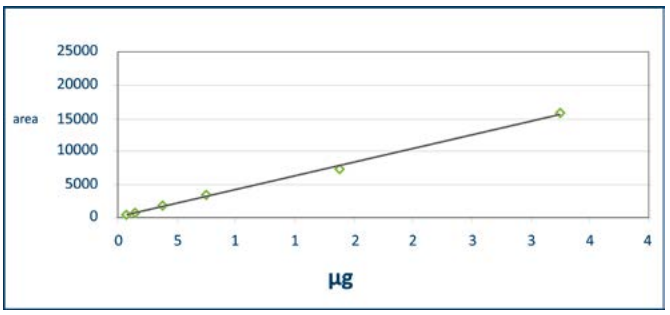


Figure 2

Correlation of results

Linearity and repeatability are achievable with any PETes AA Analyzer at any location.
The PETes method produces analysis results that differ from conventional methods, however the PETes AA Analyzer has the facility of automatically correlate the PETes results to conventional Head Space Gas chromatography. Using a linear equation, the real ppm value from the PETes AA Analyzer can be elaborated into that of a conventional method. Figure 3 shows a correlation table.

Preform	weight	area Petes	volume	correct volume	K volume	area calculated	real AA ug	Petes ppm	Trad. HS ppm	calculated K factor	delta methods
1	16,50	26600	12,4	137,6	1,09	24408	5,9	0,36	4,0	4,0	0,0
2	16,32	42358	12,2	137,8	1,09	38906	9,4	0,57	5,2	5,4	0,2
3	16,43	32002	12,3	137,7	1,09	29376	7,1	0,43	4,1	4,5	0,4
4	16,47	41996	12,3	137,7	1,09	38542	9,3	0,56	5,0	5,3	0,3
5	16,47	30174	12,3	137,7	1,09	27692	6,7	0,40	4,5	4,3	-0,2
6	16,45	39135	12,3	137,7	1,09	35920	8,6	0,53	5,3	5,1	-0,2
7	19,20	25976	14,4	135,6	1,11	23485	5,7	0,29	3,2	3,6	0,4
8	19,12	35226	14,3	135,7	1,11	31863	7,7	0,40	4,5	4,3	-0,2
9	19,04	22918	14,3	135,7	1,11	20739	5,0	0,26	3,3	3,4	0,1
10	19,00	30663	14,2	135,8	1,10	27754	6,7	0,35	4,4	4,0	-0,4
11	19,35	21409	14,5	135,5	1,11	19340	4,7	0,24	3,0	3,3	0,3
12	19,10	31152	14,3	135,7	1,11	28181	6,8	0,36	4,3	4,0	-0,3
13	19,45	36282	14,6	135,4	1,11	32758	7,9	0,41	4,4	4,3	-0,1
14	19,20	49870	14,4	135,6	1,11	45088	10,9	0,57	5,6	5,3	-0,3
15	16,82	36764	12,6	137,4	1,09	33676	8,1	0,48	4,6	4,8	0,2
16	16,45	43352	12,3	137,7	1,09	39791	9,6	0,58	5,7	5,4	-0,3

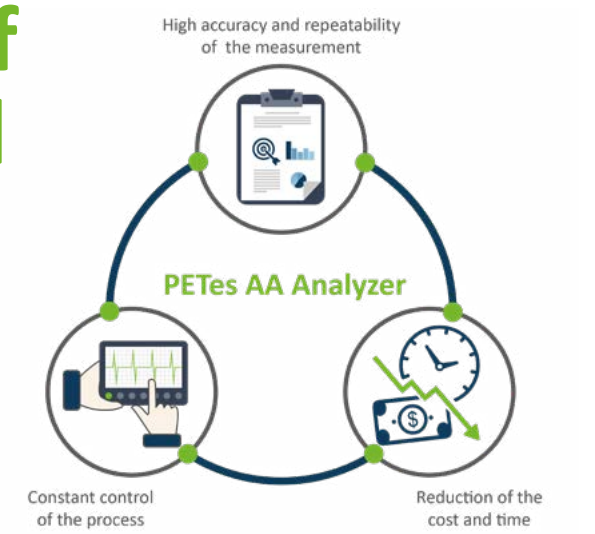
Figure 3

Features and requirements

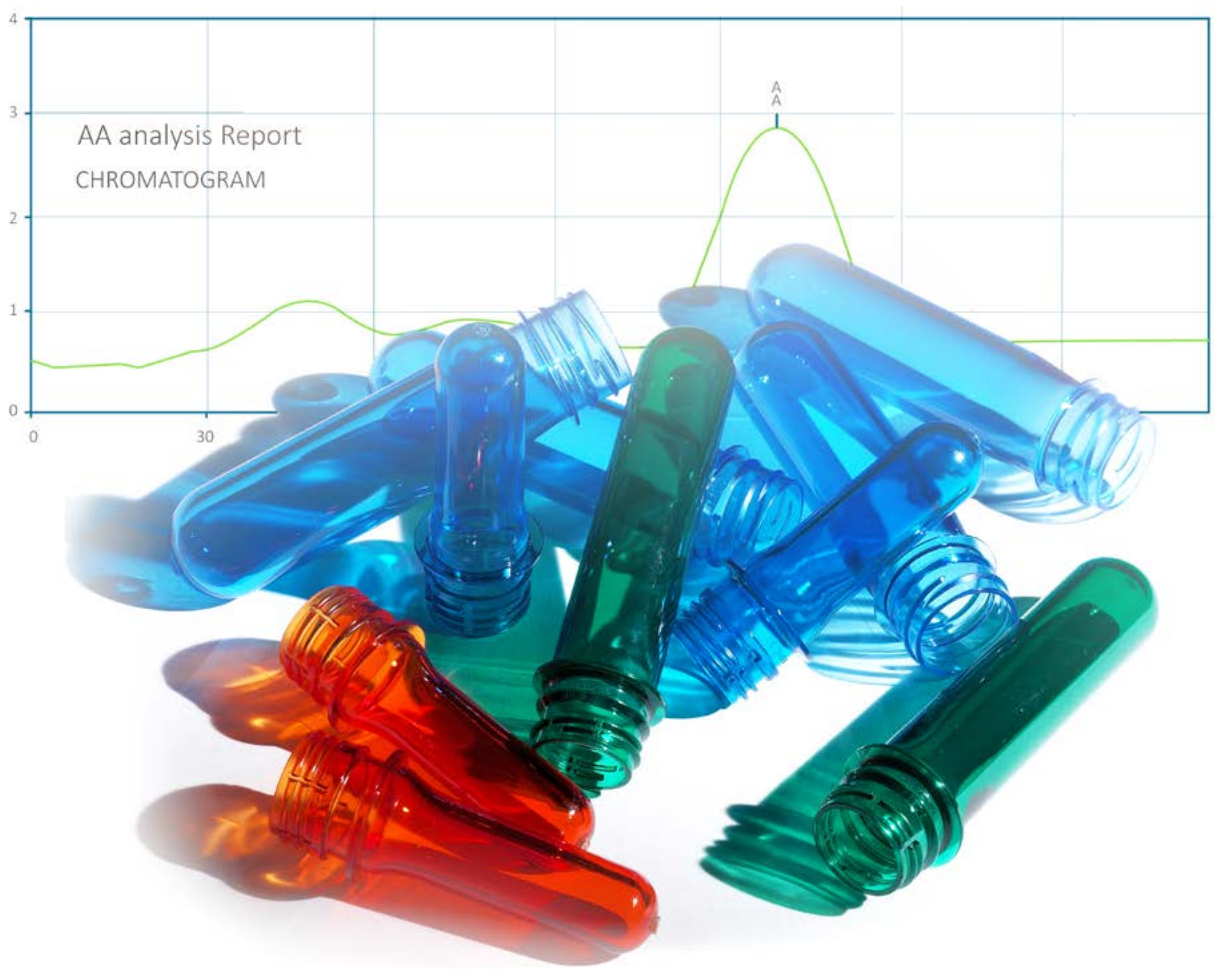
- Compressed air and power supply required
- For installation along the injection moulding machine (stand alone, ready to use)
- Integral carrier gas (H2) and calibration gas generator
- Industrial PC control, key board, printer

The advantages of the PETes method

- Repetitive and repeatable results in any location or condition
- Easiest to use
- No need for sample preparation, no human influence
- Constant control of the process
- Highest levels of accuracy and dependability of the measure
- Cost and time reductions of the AA test



The key for reliable and repetitive results in AA analysis is to limit the sample pre-treatment steps, to automate the process, to reduce overall time and effort and to prevent opportunity for imprecision and accuracy errors. **PETes AA method hits the mark**. By using the gas chromatography technology, but with no need for sample preparation, milling and processing by expert lab technicians, the PETes AA Analyzer can analyse the entire preform in a fully automatic manner. It is **simple to use**, **rapid**, and it provides **reliable** and **repeatable results**.



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