AddiMet ™

On-line Polymer and Additives Analysis

INTRODUCTION

AddiMet™ is a complete and flexible approach to the on-line analysis of polymers and additives. It is modular in design allowing the system to be optimally configured for the application. UV options provide the high sensitivity for the measurement of low level antioxidants e.g. Irganox®, Irgafos® and BHT (this cannot be done in the NIR). The NIR option allows the determination of bulk composition and prediction of physical properties of the polymer matrix. Several of these options can be cost effectively combined into a single system.

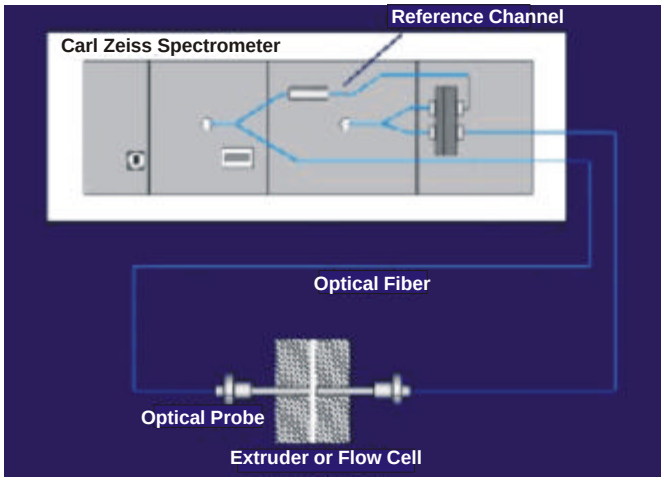


Figure 1: On-line analyser

THE ANALYSER

The System consist of a Carl Zeiss MCS 500 photodiode array UV/visible spectrophotometer which is interfaced to the process via optical probes and optical fibers. A PC running a dedicated software package written in LabVIEW™ controls the spectrophotometer. *Charm Works*™ Partial Least Squares (PLS) tools are embedded in this application in order to predict the additive concentrations. The MCS 500 Carl Zeiss modular spectrometer is the heart of the analyser system. The unique design of the spectrometer ensures reliable measurements in the harshest industrial environments. The analysis is made directly in the process stream (melt) using optical probes. These operate at up to 10,000 psi (660 bar) and over 250° C and can be installed within a process rheometer or a flow cell. A fiber optic connection between the probes and the spectrometer enhances the flexibility of the system.

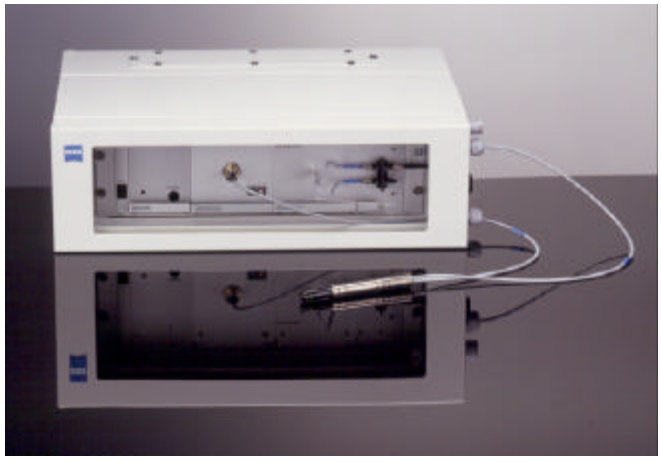


Figure 2:
MCS 500 series

THE BENEFITS

- Analysis time greatly reduced
- Tighter control of blending process is achieved
- Reduced wastage
- Customised installation

THE SYSTEM

Probes

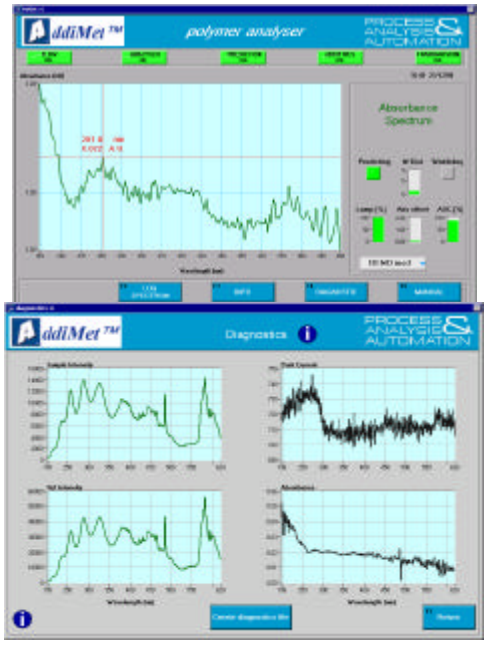
Maximum operating temperature
Operating pressure
Optical fiber
Spectrophotometer
Computer

Digital interface

Polymer Melt Probes mounted in a melt measurement platform ***(Rheometric Scientific).***
250°C
in excess of 10,000 psi.
600 µm silica core
Carl Zeiss MCS UV series
at least a Pentium 166 MHz PC with 24 Mbytes of RAM running Window NT
the computer is equipped with a National Instruments interface card, enabling the performance of the system to be monitored by the process control system and to generate local alarms.

THE SOFTWARE

AddiMet™ software controls the spectrometer, analyses the data and communicates with process control system (all industrial communication protocols supported). AddiMet™ uses the PLS (Partial Least Squares) algorithm to predict in real time the concentrations of antioxidants (simultaneous multicomponent analysis) or the physical properties of the polymer.
The PLS calibration set is obtained from liquid chromatographic analysis on samples removed from the extruder. About 30 samples, evenly covering the concentration range, are required. The exact number of samples depends on the number of additives to be analysed and the quality of the reference analytical data. The model can be upgraded and optimised by adding new training samples at anytime.The use of PLS enables simultaneous on-line analysis of multiple additives. Thus further reducing analysis time.The composition of the polyethylene melt is inferred in real time rather than waiting several hours for off-line chromatographic analysis. The measurement period is typically 10 seconds. The software on the associated PC processes the spectra on demand and passes the additive concentrations to the process control system.



AddiMet™ software is licenced exclusively to Carl Zeiss by Process Analysis and Automation Ltd

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In-line Analysis of the concentration of flavoured mineral waters

INTRODUCTION

For a few years now mineral waters have been flavoured with additives in order to modify the taste.
These additives, the likes of "Lemon" for Mineral Waters, are dissolved in alcohol and are added to the mineral water in strongly diluted form (approx. 1:1000). The desired concentration is determined by subjective "tasting" and then released to the filling facilities. An evaluation of samples taken before and during the filling process can provide objective measures of the concentration of the additives in the final product. Chemical tests on production samples represented another approach to the problem.
In-line monitoring of the current concentration of the additives in the production stream by means of immersion probes or flow-though cells provides the possibility of direct process control. Thus it is possible to increase the continuity of the concentration in the final products.

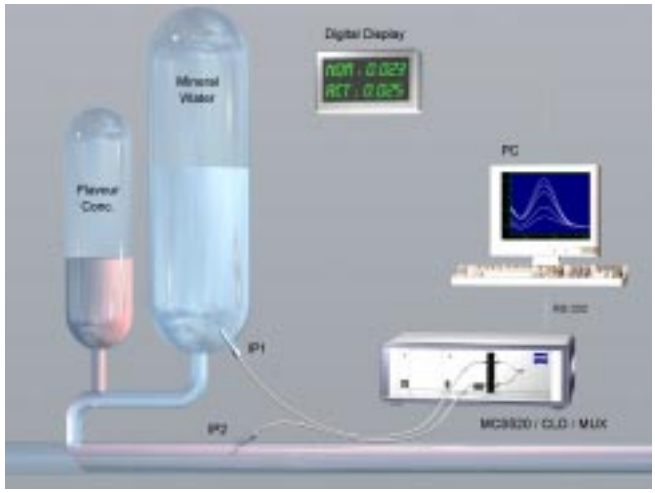

Figure 1: In-line monitoring

THE METHOD

The concentrated flavour additives dissolved in alcohol generate typical absorbance in the UV spectral range. The example shows a real sample (mineral water 'lemon') and a dilution series of this sample. (Figure 2) A tolerance window is specified to enable the process control adjustment of the added concentration.

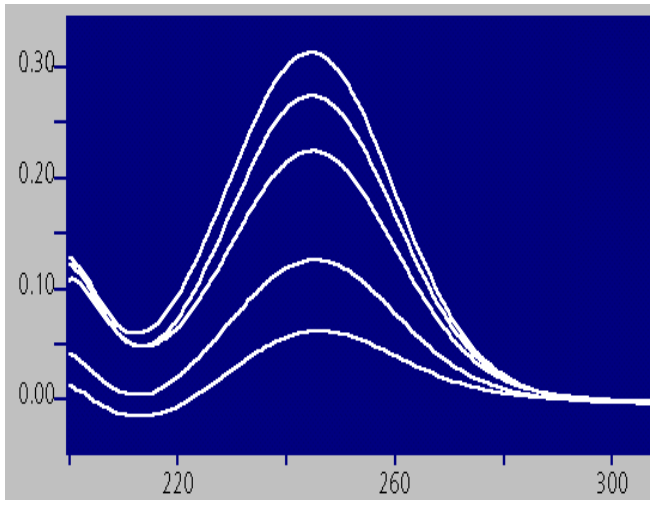

Figure 2: Sample

THE SYSTEM

The diode-array spectrometer system MCS551UV based on the established Zeiss MCS polychromator technology provides spectral information in the UV range with a resolution of 0.8 nm / pixel.
The system is controlled by a PC, different interface types (RS422, 4-20 mA loops or trigger I/O ports) can be applied. Systems can be cascaded and controlled via one host PC to take measurements in different streams.

THE SOFTWARE

The DM1 software (LabView generated) runs under Windows NT. The process monitoring programme provides a results display of up to 4 measuring channels. The concentration of the additives in the stream can be displayed as digital readouts of the current values and/or in form of trend charts. Storage of the results and data transfer via an analog output are possible.
Digitally controlled devices like e.g. valves or shutters used to switch product or reference streams can be included in the automated signal processing.

THE BENEFITS

- Fast and continuous measurement
- Short analysis and response time
- Established and proved system and method
- High reliability, low maintenance
- Easy to use software
- Detailed spectral information available at high speed
- Fibre optics allow flexibility in installation and location of the system

SYSTEM SPECIFICATIONS

Wavelength range	200-620 nm (optional 190-1020nm and/or 900-1700 nm)
Wavelength resolution	0.8 nm/diode (2.4 nm Rayleigh)
Wavelength reproducibility	< 0.005 nm
PC interface	RS 422
Distance between PC and system	up to 80m with standard cable up to 2500m with waveguide transmission
Analog output (4-20 mA)	4 channels (standard)
Optical fibres	quartz, 600 µm core, SMA connector Max. distance 10 m
Housing	19” rack 19” protective housing

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