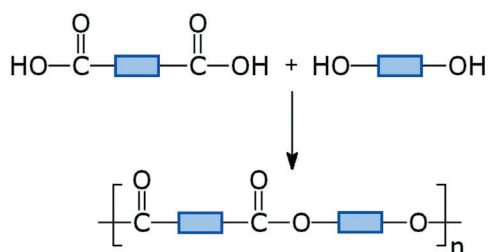


## Application Note AN N520

# Online Monitoring of Acid Number and OH Number during Polyester Resin Production

Polyester resins are unsaturated synthetic resins popular for their diversity in usage. Manifold applications, e.g. sheet molding compounds for the automobile and transportation industries, fiberglass or quartz reinforced products for kitchen and restaurants, polyester concrete overlays for roads and bridges or even textiles can be realized.

The unsaturated polyester resins are formed by chemical reaction of saturated and unsaturated di-carboxylic acids with alcohols.



They form highly durable structures and coatings when they are cross-linked with a vinyl reactive monomer. The properties of the cross-linked unsaturated polyester resins depend on the types of acids and glycols used and their relative proportions. The reactions are running over several hours and with temperature from 185 to 250°C. The choice

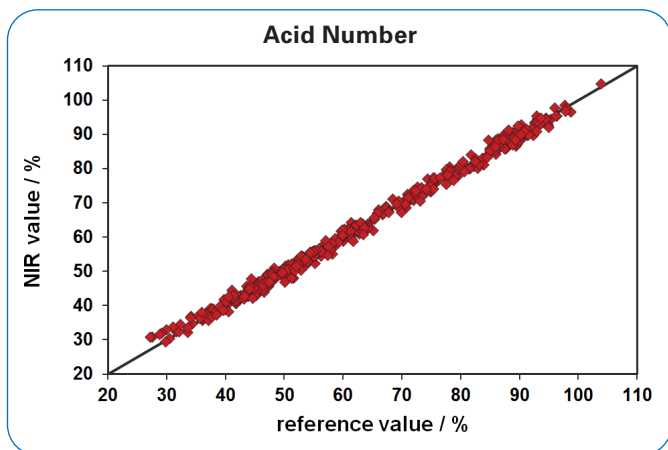
and the composition of the educts together with the reaction temperature and the reactive diluent determine the manifold properties of the polyester resins.

At all stages of the process it is critical to monitor the parameters Acid Number and OH Number online. This way the reaction endpoint can be accurately determined, bad batches are avoided, and the quality of the end products can be kept within narrow specifications. FT-NIR process spectroscopy is a proven tool and used widely across the industry.

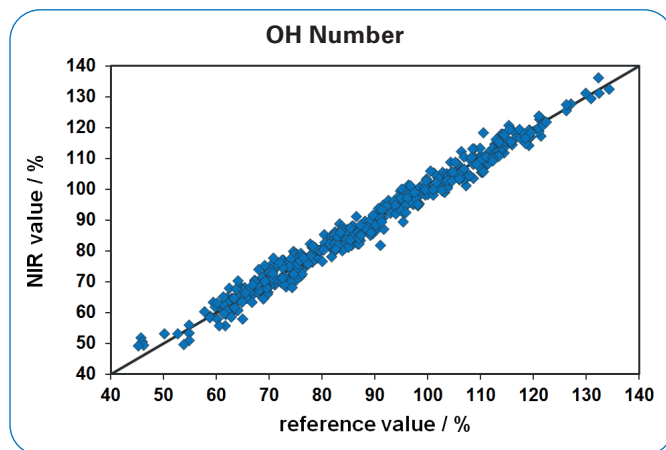
### FT-NIR Measurement

Since the products are typically a transparent liquid, it can be easily analyzed using a fiber optic transmission probe installed directly in the reactor or in a by-pass line. With the MATRIX-F process spectrometer up to six measuring points can be monitored with only one spectrometer optimizing the return on investment of such a project.

Process communication protocols like Profibus DP, Modbus, OPC DA or 4-20mA allow the transfer of all necessary information to the DCS for optimized process control.



Cross validation results of a PLS based model for the online prediction of the Acid Number during the Polyester reaction



Cross validation results of a PLS based model for the online prediction of the OH Number during the Polyester reaction

## Quantitative Analysis

Near-infrared spectra result from combination and overtone bands of C-H, N-H, and O-H vibrations. Since the reaction mixtures contain organic components containing these bonds, they are ideal for near-infrared analysis.

The OPUS/QUANT quantitative analysis software package uses partial least squares (PLS) to develop quantitative models. Typically the development of a model requires measuring samples that contain a range of concentrations of the components of interest. In this example, NIR spectra of the reaction mixture were collected continuously in a pilot plant and correlated via their time stamp to samples pulled from the reactor and analyzed off-line.

## About Bruker Optics

Bruker Optics offers a wide variety of instrumentation to meet your specific needs:

- The TANGO offers an efficient and cost-effective analysis for material identification and quantification of constituents in a wide variety of application fields.
- The MPA II (Multi Purpose Analyzer) is ideal as a laboratory or at-line system for quality control. It offers a complete solution for all analysis sampling needs, including liquids, and powders.
- The MATRIX-F is a rugged FT-NIR spectrometer ideally suited to on-line/in-line process monitoring of liquids and solids based on fibre optic probe technologies.

**FT-NIR Spectrometers:** Bruker Optics offers various FT-NIR spectrometer models for lab, at-line and on-line applications:



Touch-screen operated FT-NIR analyzer for routine use in the lab and atline.



Multi Purpose Analyzer for maximum flexibility with ease-of-use.



Process monitoring with probes and contact-less sensor heads.

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