



CONCENTRATION MEASUREMENT OF HYDROCHLORIC ACID



Chemical Industry

“Continuous concentration measurement in the plant enables us to optimize the process in terms of efficiency and production capacity.”



*Dr. Marcel Musenbrock,
Operations Assistant for amines,
neopentyl glycol and special alcohols,
OQ Chemicals*



Measuring Task

Continuous determination of the water content in neopentyl glycol melt

Oxo products are the core competence of OQ Chemicals.

The company produces more than 70 oxo chemicals for a wide range of industries with different applications. The Ruhrchemie plant in Oberhausen is the cradle of oxo chemistry: Otto Roelen's work in the field of hydroformulation (oxo synthesis, a reaction of olefins with carbon monoxide and hydrogen) in 1938 pioneered the use of fossil raw materials for the production of aldehydes and their derivatives.

In the oxo derivatives segment, OQ Chemicals produces acids, polyols, amines, special esters, higher aldehydes and special derivatives for a wide range of applications at the Oberhausen site. The main polyol products are neopentyl glycol (NPG), trimethylpropane (TMP) and 1,3-butylene glycol.

NPG is used in the polysynthesis of polyesters, coatings, lubricants and plasticizers. It provides outstanding performance in many end-use applications, e.g. in powder coatings and in the production of saturated polyester resins. In order to meet increasing customer demand in Europe, a debottlenecking project began in 2018 at the Oberhausen production site.

NPG is a solid with a melting point of around 260 °F. Since solids are

difficult to handle, the melting point is lowered for sales and transport by adding water. Compliance with the specified water content must be monitored using measurement technology. This was done by titration in the laboratory. In the course of the planned conversion from batch to continuous production, the company was looking for a suitable method for the continuous determination of the water content in the process.



Solution

In search of a process-compatible continuous measuring method, the company installed various measuring devices over the last 15 years, most recently an infrared spectrometer. In terms of reliability and measurement accuracy, none of them proved to be suitable to replace

regular sampling and titration in the lab.

At the OQ Ruhrchemie plant, FLUXUS® clamp-on ultrasonic systems have been measuring the flow rate in various applications for many years. Given the highly positive experience with the practically wear and maintenance-free measurement from the outside of the pipe, the process engineers turned to Flexim to explore the possibility of non-intrusive determination of the water content in NPG with clamp-on ultrasonic measuring technology.

In fact, the non-intrusive measurement of acoustic velocity is suitable as an ideal method of process analytics in many applications. However, the corresponding examination of an NPG sample in the Flexim laboratory produced a negative result. The change in the acoustic velocity with the water content is too small to be able to guarantee the measurement accuracy of ± 0.1 M% water required for process control.

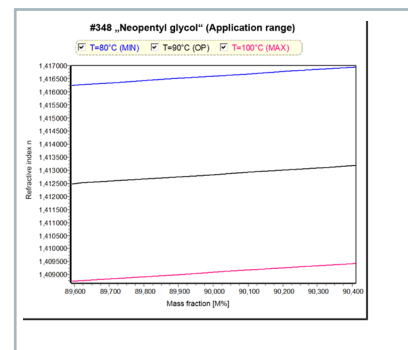
However, Flexim measures optically as well as acoustically: the PIOX® R process refractometer measures the refraction of light in the medium using the transmitted light method patented by Flexim. The refractometric measurement of the NPG sample showed a practically linear relationship between water content and refractive index. OQ Chemicals therefore decided to check the suitability of PIOX® R for the measurement task as part of a twelve-week test in the process.

The test was successful but also showed potential for optimization: Because of the temperature dependency of the refraction of light and the temperature fluctuations when water and NPG are mixed, the temperature in the process must be measured precisely and the media data record must accurately reflect the relationship between temperature, refraction and concentration. After appropriate adjustments, PIOX® R measures in good agreement with the results of the titrations in the laboratory. OQ Chemicals therefore decided to buy.

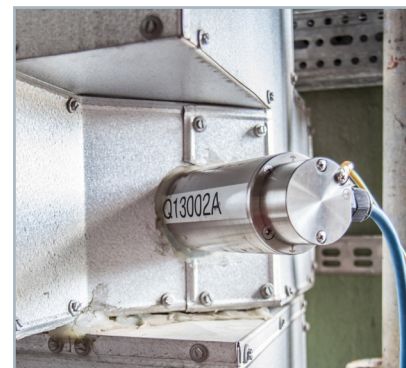


The oxo plants at the OQ Chemicals Ruhrchemie site

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At a constant temperature there is a linear relationship between the water content in NPG and the refractive index.



The PIOX® R400 process refractometer is installed in a 2" circulation pipeline.



The PIOX® R704 measuring transmitter calculates the water content from the measured light refraction and feeds the measured values into the process control system.

Measuring Points and Instrumentation

Pipelines	2" stainless steel
Medium	neopentyl glycol melt with water, water content 9.6 – 10.4 M%
PIOX® R400A1 process refractometer (for ATEX zone 0/1), chemical version, 2" process connection flange	
PIOX® R704 RI-A2 measuring transmitter	

SELLING POINTS

- Continuous determination of the water content enables automatic control and ensures compliance with the specified quality at all times.
- The measurement of light refraction using the patented transmitted light method combines high accuracy with process reliability.

Customer:

OQ Chemicals Produktion GmbH & Co. KG, Oberhausen, Germany

OQ Chemicals (formerly OXEA) is a global manufacturer of oxo intermediates and oxo derivatives such as alcohols, polyols, carboxylic acids, special esters and amines. These are used to manufacture high-quality coatings, lubricants, cosmetic and pharmaceutical products, aromas and fragrances, inks and plastics. OQ Chemicals employs more than 1,400 people worldwide and is part of OQ, an integrated energy company with origins in Oman. OQ was created in 2019 after the successful integration of nine companies.

With around 850 employees, the Ruhrchemie plant in Oberhausen is the world's largest production site for OQ Chemicals.



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