

Case Study

Inline Monitoring of the Concentration in Chemical Processes

For optimisation of product quality, production efforts and plant safety nowadays chemical processes are monitored by analytical inline and online technology. Advantages over conventional manual analytical methods include continuous measurement, real-time data output and omission of time-consuming lab analysis. Therefore, the chemical group Lanxess decided on an automatic process control of its plants by using the LiquiSonic® concentration analyser.



Figure 1: Variants of LiquiSonic® sensors

In different areas of the chemical industry, the control of industrial processes is essential for reasons of quality, efficiency and safety. Depending on the process, different parameters have to be considered. So the concentration of raw materials or final products can be monitored during the production of chemical substances or the separation of phase transitions.

Monitoring of the concentration is also advantageous in neutralisation processes or gas scrubbers in order to achieve maximum efficiency of the absorption.

Reducing the reject rate with inline analysis

In chemical processes, the monitoring should be done directly in the process, continuously and on a real-time basis. The method taking samples manually and analysing in the laboratory is sometimes still applied, even though process analytical technology provides reliable methods that measure inline and without any time delay.

So it is possible to react very fast on deviations from the desired value and to control the process in an optimal way. This results in both quality and process safety as well as cost savings and increasing yields. Avoiding under- and overdosing causes, on the one hand, a reduction in

the energy consumption as well as the use of important raw materials.

On the other hand, defective batches can be reduced what eliminates costs for failure and correction, sunk material and energy costs and lost working hours.

Measuring method	Max. temperature	Max. pressure	Lifetime	Investment	Remark
Refraction index	150°C	25 bar	Limited	Average	Sensitive to contamination
Conductivity	180°C	40 bar	Unlimited	Low	Only applicable in inorganic substances
pH-value	140°C	15 bar	Limited	Low	Continuous maintenance due to calibration
Density	150°C	100 bar	Limited	Average	Bypass necessary, sensitive to contamination
Sonic velocity	200°C	250 bar	Unlimited	Average	Corrosion resistant due to special material

Table 1: Comparison of different measuring methods



Figure 2: Immersion type sensor and controller of a LiquiSonic® analyser

In order to realise a concentration monitoring, there are different measuring methods available, which vary in their suitability and user-friendliness. Table 1 gives an overview about typical application specifications. As most measuring methods are restricted to operation temperature or pressure, the sonic velocity is able to withstand tough conditions. The sonic velocity measurement convinces beside the conductivity, also regarding lifetime that can be achieved.

However, the conductivity can be used in inorganic substances only. In addition, many measuring methods reduce the user-friendliness caused by maintenance

efforts or complex installation requirements. Finally, the sonic velocity emerges as adequate measuring method for lots of chemical processes.

The analyser LiquiSonic® of the company SensoTech uses the sonic velocity to determine the concentration of process liquids. The analyser is made in Germany and works precise and maintenance-free.

The measuring principle is based on a runtime measurement, with which the signal velocity is detected. Depending on the material characteristics, there will be a change in the signal respective sonic velocity.



Figure 3: The installed LiquiSonic® immersion type sensor measures the concentration reliably and precisely over years in a plant of the company Lanxess

Figure 1 shows a LiquiSonic® analyser that consists of one forked sensor with electronic housing and a controller as evaluation unit. Depending on the process conditions, there are different sensor and controller types available. Figure 2 gives an overview of some sensor variants. The sensor has a completely enclosed design. At one side of the sensor, a transmitter is integrated that generates an ultrasonic signal to the receiver located at the other fork side.


The measuring principle is based on a runtime measurement, with which the signal velocity is detected. Depending on the material characteristics, there will be a change in the signal respective sonic velocity. Due to a functional relation it is possible to calculate the concentration from the sonic velocity.

Detecting process problems immediately

For many years, a LiquiSonic® analyser is used in an operational plant of Lanxess in Leverkusen, Germany. The device measures the product concentration in a plant compared to the reference value. If the measured value deviates from the reference value, the controller gives out a warning message. The controller is connected via Profibus to the process control system, so that actions can be taken immediately. Since the product is a hazardous substance, an inline process control is also recommended because of safety reasons instead of manual sampling and analysis.

The product is stored in a tank. The sensor made of stainless steel 1.4571 is installed in the transmission pipeline and collects precisely updated measuring values within seconds. The sensor communicates with the controller over a digital connection. In case of expanding the plant with more measuring points, it is possible to use the same controller that manages additional sensors. This causes comparatively low investment costs.

Figure 3 shows the installed LiquiSonic® immersion type sensor. The analyser is running the entire time stably and maintenance-free. Highly precise sensor technology, the robust construction and the application knowledge of SensoTech make the inline process control reliable and long-lasting. ■



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