To produce chlorine through electrolysis, purified brine is required. Turbidity measurements following precipitation and filtration allow real-time monitoring and help to detect filter breakthrough. This enhances process reliability, protects the expensive membrane in the electrolysis cell, and minimizes downtimes.

Background

Chlorine is a key raw material for the chemical, pharmaceutical, and crop protection industries. It is produced mainly by electrolysis of sodium chloride brine in either a diaphragm, membrane or mercury cell. In each process brine is electrolyzed by a direct electric current (DC) that converts chloride ions into elemental chlorine.

Salt is obtained from the mining of natural deposits or from seawater, and contains impurities, mainly minerals and metals. These can adversely affect the electrolytic cell by clogging and damaging the membrane or diaphragm. Therefore, the brine fed into the cells needs to be as pure as possible and free of contaminants.

The contaminants precipitate by adjusting the pH and by the addition of chemicals. Subsequently all precipitated and suspended contaminants are removed by filtration.

Turbidity measurement systems are particularly suitable for monitoring and increasing the efficiency of the precipitation and filtration processes.
Brine purification process

The raw brine is obtained by dissolving solid salt in the salt dissolver. It contains various impurities, mainly Ca and Mg. These can have a negative effect on the function of the electrodes and separators, or on the cell performance in the electrolysis process itself. It may also impact the final product quality. After concentration, the brine is chemically pretreated. Sodium hydroxide (caustic soda) and sodium carbonate are added under controlled stirring, resulting in the formation of non-soluble hydroxide and carbonate salts which are allowed to settle. For the real-time monitoring of particle concentration during precipitation the use of an appropriate turbidity measurement system offers strong advantages.

The precipitated calcium carbonate and magnesium hydroxide are subsequently removed by filtration. Continuous, direct monitoring of the filtration process by means of inline turbidity measurement enables early detection of filter breakthrough and substantially enhances process reliability and protects the expensive electrolysis membrane. Any contamination at this point will reach the cell, resulting in damage of the membrane. This would cause a reduction of the cell current resulting in lower productivity and a shorter lifetime of the membrane.

The clear and purified brine feed is then suitable for the production of chlorine.

Typical values are 15–20 NTU before, and less than 1 NTU after the brine filtration process.

METTLER TOLEDO solution:
Monitoring of precipitation Turbidity sensor InPro 8200

A turbidity sensor of the InPro 8200 series, based on backscattered light technology, is very well suited for monitoring a precipitation process. These sensors are available in different materials and sizes.

For instance, the sensor body can be made of stainless steel or Hastelloy, depending on the requirements of the customer. The use of sapphire windows guarantees longtime performance. The instruments are certified for use in hazardous areas. The 12 mm sensor design can be used either with static or retractable housings. In a retractable housing, the sensor can be conveniently removed for servicing or replacement without process interruption, minimizing downtime for sensor maintenance.

Turbidity transmitter Trb 8300

The advanced turbidity transmitter provides reliable measurement over a broad turbidity range and, together with the sensor InPro 8200, is particularly suitable for the monitoring and measurement of suspended solids in precipitation processes. Full text menu operation and online help text guarantee short start-up times and smooth control of the measurement loop. The wide measurement range, choice of various measurement units (e.g. NTU, %, ppm), and easy operation are unique features of this cost-effective turbidity transmitter.
**Monitoring of filtration 2**  
**Turbidity sensor InPro 8400**

The use of forward scattered light in the sensor InPro 8400 provides an ideal and reliable means of monitoring of filtrate quality and early detection of filter breakthrough during brine filtration. This sensor has been designed for accurate inline measurement at the very low to medium turbidity levels. The InPro 8400 is available in different versions to meet the various requirements with regard to process and installation in pipes. The use of resistant sapphire windows permits flawless operation over longer periods. The unit is certified for use in hazardous areas.

**Turbidity transmitter Trb 8300 F/S**

This advanced turbidity transmitter features sensor diagnostics and is designed for use with the sensor InPro 8400 F/S. It provides detailed information on sensor status and performance, and simplifies and reduces maintenance effort. Full text menu and online help texts guarantee short start-up times and easy handling of the complete system. It also incorporates an RS232 interface for data transfer. This flexible transmitter ensures substantial time savings on operator training and product installation.

**Benefits**

- Increased efficiency with precipitation monitoring
- Real-time detection of filter break-through protects the electrolytic cell from impurities
- Less downtime
- Extended lifetime of the electrolysis membrane

**Advantages of Turbidity sensor InPro 8400**

- Precise measurements at very low turbidities with the forward and/or 90° scattered light principle
- Color compensated turbidity measurements through the ratio beam principle
- Quick start-up with factory calibration in industry specific units
- Low maintenance thanks to reduced fouling of the sensor’s sapphire optics

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**Measuring principle of forward scattered light sensors**

![Diagram of measuring principle](image)
Process safety and reliability with Transmitter Trb 8300 F/S

- Suitable for operation with either an InPro 8400 or an InPro 8500 sensor
- Process and multipoint calibration procedures
- Full text menu guide in three languages and online help texts
- Sensor diagnostic features for predictive maintenance
- Menu password protection on two levels
- RS 232 interface for programming with sensor factory calibration data, data transfer of configurations and software updating

www.mt.com/turbidity

www.mt.com/transmitters