

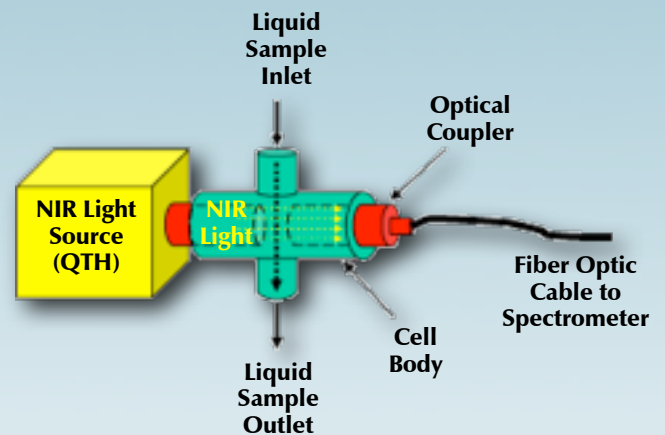
Chlorine Dioxide Analyzer

Description

The Duralyzer-NIR ClO₂ Analyzer is a turnkey solution for carrying out chemical analysis of Residual Chlorate, Residual Sulfuric Acid and ClO₂ in Chlorine Dioxide production plant. The standard configuration supports one or two sample lines. The system is based on the DURALYZER™ series of industrial spectrometers. The analyzer package consists of an industrial spectrometer configured for chemical analysis. Sampling hardware is connected to Generator and Absorption Tower outlets to interface sample lines into the system. Sampling and cleaning is completely automated.

The unique design of this system minimizes maintenance and system cost by eliminating the large number of moving parts associated with autotitrator technology and eliminating the high pressure or steam washing system used with refractometer approaches. Unlike single point measurements such as refractometers, conductivity meters and density meters, the spectrometer approach provides a complete component analysis such as an autotitrator system without the maintenance and cost associated with autotitrator systems.

The transmission cell provides a means for NIR radiation to interact with the process sample while isolating the light source, fiber optic cable and spectrometer from the process. A typical transmission cell is composed of a body with appropriate sample inlet and outlet connections and a pair of optical couplers to deliver light to the sample and collect light after interaction with the sample. The optical couplers house a set of lenses to focus the radiation onto the tip of the fiber optic cable. The ends of the couplers in contact with the process sample have windows, usually sapphire, to provide a transparent optical path for the entering and exiting light as well as providing isolation from the process sample. Sapphire is usually the material of choice for the coupler windows due to its combination of hardness, chemical and heat resistance and transparency over a broad range of wavelengths.



Duralyzer-NIR Chlorine Dioxide Analyzer

Application Technology

THE CLO₂ PLANT CHEMICAL ANALYZER provides a reliable and accurate analysis of the critical chemicals in the R-10 (Solvay) process, with measurements every 5-10 minutes.

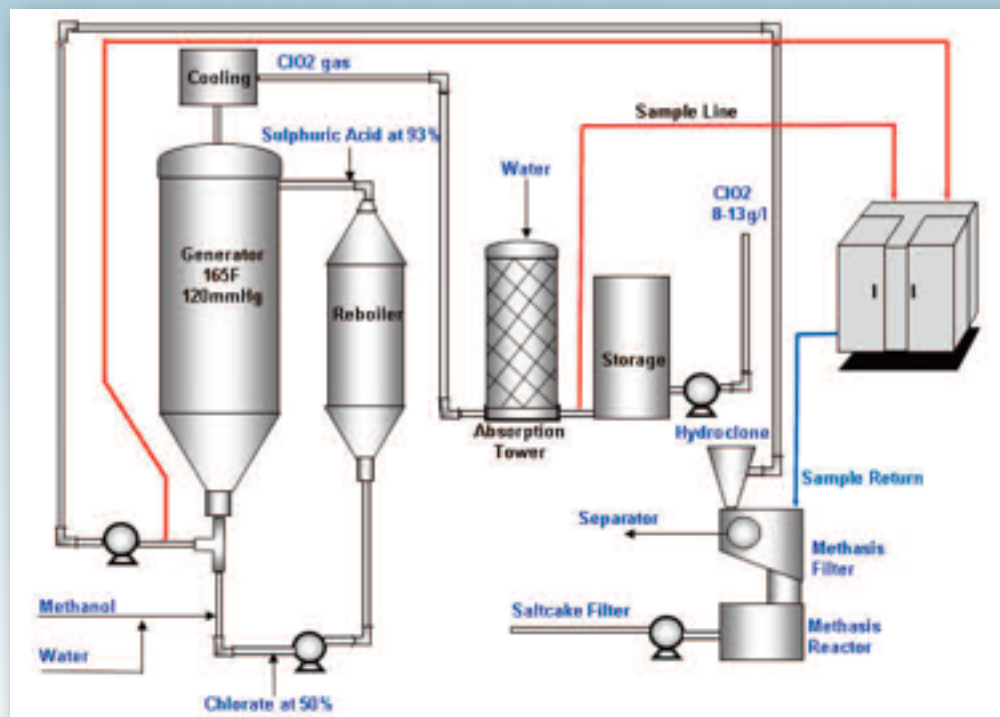
In this particular process the overall Chemical Reaction formula is: $6\text{NaClO}_3 + \text{CH}_3\text{OH} + 6\text{H}_2\text{SO}_4 = 6\text{ClO}_2 + \text{CO}_2 + 6\text{NaHSO}_4 + 5\text{H}_2\text{O}$

In a typical manual control scheme the ClO₂ Production rate is controlled by the amount of Methanol feed to the Generator. By using look-up tables, the Chlorate and Sulphuric Acid feeds are adjusted by the plant operator. As the Chlorate and Acid concentration vary among any other process variables, the Generator outlet chemical composition is tested in the lab typically every 2 hours. The goal is to maintain Chlorate concentration Molarity at 1-4 and Acid concentration at 7-10-Normal. The make-up chemical feeds

are adjusted accordingly based on the lab results. However, this very slow sampling frequency and the required production rate changes result in poor efficiency and chemical losses, especially for the expensive chlorate. The final control function is the water addition to the ClO₂ Absorption Tower in order to maintain a constant, desired ClO₂ concentration.

Utility Requirements

- ✓ **Electrical:** 110-120 VAC/60Hz, 30 Amp
- ✓ **Air:** Instrument air 70-120 psi, 3/8" SS tubing
- ✓ **Sample Lines:** 1/2" SS tubing, 3/4" EPDM hose
- ✓ **Drain:** 1" hose back to process
- ✓ **Water:** Mill water 40-80 psi, 3/4" tubing
- ✓ **I/O:** 4-20mA or MODBUS/TCP



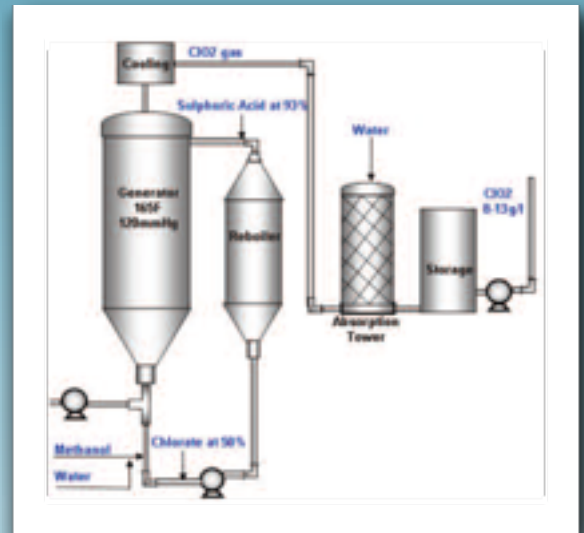
Duralyzer-NIR Green Liquor Analyzer

Chlorine Dioxide Plant Advanced Control Technology

Chlorine Dioxide (ClO₂) is the most important bleaching agent in the pulp and paper industry for Elemental Chlorine-Free (ECF) bleaching. Different bleaching sequences must be used in the production of various pulps. This depends on the pulping process used, the residual lignin content of the pulp, and the target brightness. Key goals at most pulp mills include the optimization of reaction efficiency of ClO₂ generators, the proper dosage of chlorine dioxide, and improving the control of vent-gas scrubbers to reduce chlorine dioxide emissions into the atmosphere.

Reliable and accurate chemical analysis of the ClO₂ generation process is important for optimizing the efficiency and chemical consumption of it. Due to the complexity of this process, the Chlorate and Sulphuric Acid levels in the Generator need to be constantly monitored, after which an advanced control algorithm can then be fairly easily implemented. Even a small improvement in reducing the variations inside the Generator will result in a rapid payback from the DURALYZER-NIR based Advanced Control System.

Advanced Control is required for optimum performance of the generator due to reverse relationships of the main chemicals Sodium Chlorate and Sulphuric Acid. Due to the complex relationship between the three main chemicals, Model Predictive Controller (MPC) is used to control Methanol flow addition and set point correction to H₂SO₄ flow.



Benefits of Optimizing the ClO₂ Plant:

- Lower Chemical Consumption
- Reduced Cost
- Increased Plant Safety
- Reduced Environmental Impact
- Better Bleaching Quality due Reduced Variability

