Eka® chlorine dioxide generation systems

eka®

We help make pulp white and bright!

We are Nouryon, a global specialty chemicals leader. We produce essential chemicals and are experts in highly demanding chemistry. Nouryon is a specialist in the design and supply of chlorine dioxide plants and equipment to the pulp and chemical industries.

Nouryon has designed, built, re-built, handled spare parts and operated chlorine dioxide (ClO_2) systems for pulp bleaching for over 50 years. As the international leader in ClO_2 technology, we offer service, support, spare parts and equipment for the large-scale production and application of both vacuum and atmospheric processes. We can supply all the ClO_2 processes needed to match your requirements, from the design and procurement of the process equipment to a complete turnkey installation. Our experience and know-how ranges from rebuilds of existing plants to brand new installations. We operate globally and offer our customers quick and personal service 365/7.

Chlorine dioxide systems

Eka Engineering is a world-leading supplier of chlorine dioxide (ClO_2) plants. We have developed a number of different process technologies for safe and efficient ClO_2 generation.

The new standard

ClO_2 is an oxidizer that has been commercially used for bleaching pulp since the mid 1940s. Today, ClO_2 is a preferred bleaching agent and is used globally in the majority of pulp mills producing bleached Kraft pulp.

It is the most cost-effective pulp bleaching agent, achieving high brightness while maintaining high fiber strength. Modern bleaching sequences involving ClO_2 produce a low level of predominantly non-toxic organo-chlorine (AOX) compounds in the bleach plant effluent, making it possible for the pulp mills to comply with the more stringent AOX discharge regulations in force in most countries in the world.

These are the main reasons why ClO_2, used in combination with oxygen (O_2) and hydrogen peroxide (H_2O_2), has replaced chlorine (Cl_2) as a bleaching agent in most parts of the world. Chlorine dioxide is the main bleaching agent used in modern environmentally compatible paper pulp manufacturing. Chlorine dioxide is the main component in ECF (Elemental Chlorine-Free) bleaching. ECF bleaching is the worldwide bleaching standard and considered the "Best Available Technique" for the production of bleached pulp.

The basic process

ClO_2 is produced on site by reducing sodium chlorate ($NaClO_3$) in an acidic solution, either under vacuum (SVP processes) or atmospheric (Mathieson, HP-A processes) conditions. Different by-products are produced by varying the type of reducing agent and acid. The first commercially viable process for producing ClO_2 used sulfur dioxide (SO_2) as a reducing agent - i.e. the Mathieson process.

Since then, several new processes have been developed, providing improved ClO_2 yield, different by-products and minimized environmental impact.

The SVP processes

The SVP (single vessel process) chlorine dioxide process family consists of a number of similar processes based on the same equipment configuration. It is relatively easy to switch from one to the other.

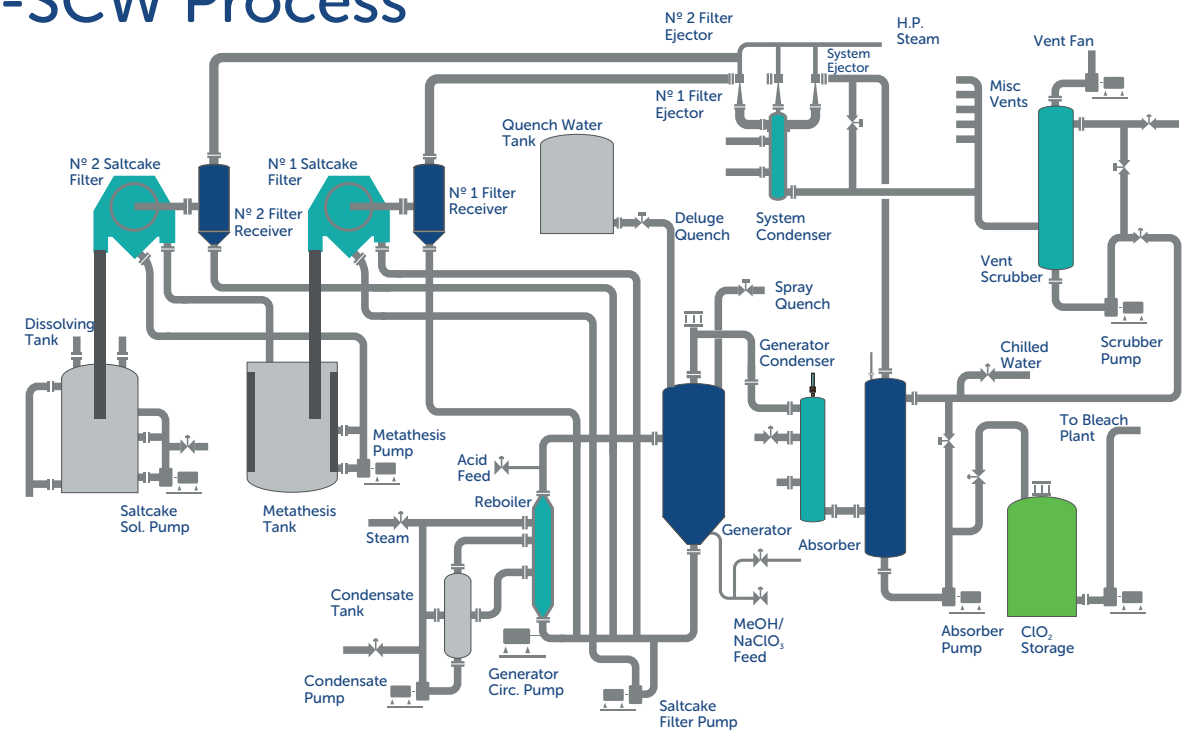
The different processes are distinguished from each other by use of different reducing agents and acids for converting sodium chlorate ($NaClO_3$), to chlorine dioxide (ClO_2). The most common process today is the SVP-LITE process based on the use of methanol (CH_3OH).

SVP-LITE Process

The production of ClO_2 in the SVP-LITE process is based on the reaction between $NaClO_3$, sulfuric acid (H_2SO_4), and CH_3OH. The heart of the process is an all-titanium ClO_2 generator, a large vessel in which the $NaClO_3$ is reacted to form ClO_2.

The generator is designed to optimize reaction efficiency, promote salt crystal growth, provide efficient liquid-gas separation and provide sufficient volume for easy control of reactant concentrations. A titanium pump circulates the generator solution through the reboiler. Unique to the process is that the components in the circulation loop are carefully designed to minimize the boil-outs. The water evaporation rate matches the rate at which the water enters the generator with the chemical feeds and utilities. The ClO_2 partial pressure is maintained at a safe level by means of a strong vacuum and dilution with water vapor.

SVP-SCW Process



Gas absorption

The chlorine dioxide (ClO_2) gas leaving the generator is cooled in the generator condenser and absorbed in a packed tower, the ClO_2 absorber, by means of chilled water. The resulting product is a strong solution of ClO_2 with negligible levels of chlorine gas (Cl_2).

The solution is then pumped to storage tanks for further use in the bleaching process. As the gas from the ClO_2 generator does not contain any diluting gases like air or chlorine, absorption efficiency is high and ClO_2 concentrations in excess of 10 g/l can easily be reached.

Typically, the vacuum in the ClO_2 generation system is created by means of a steam ejector, but a liquid ring vacuum pump could also be used.

After passing the ejector, the tail and vent gases are washed with chilled water in the vent scrubber. The effluent water from the scrubber is transferred to the main absorption tower and thus all the ClO_2 in the vent gases is recovered and added to the produced ClO_2 solution.

Sodium sulfate recovery

The sodium sesquisulfate crystals ($Na_3H(SO_4)_2$) formed in the generator are pumped to a titanium bottom feed, rotary drum filter for removal as a near dry solid. The filter is equipped with a hot water wash system. The wash water and generator liquor are withdrawn from the filter and returned to the generator, leaving behind a dry, high-quality salt cake. The $Na_3H(SO_4)_2$ is discharged into the dissolving system and pumped to the pulp mill.

This filter comes standard with a tantalum filter cloth, providing years of trouble-free service and high reliability. The filter is much less sensitive to crystal size or production rate fluctuations than competing top feed filters.

SVP-SCW – Salt Cake Wash System

The SVP-SCW process is an add-on option to the SVP-LITE process. The formed salt cake in SVP-LITE is sodium sesquisulfate ($Na_3H(SO_4)_2$), which is an acidic version of sodium sulfate (Na_2SO_4), containing about 18 wt% of sulfuric acid (H_2SO_4).

In the SVP-SCW process, the filtered $Na_3H(SO_4)_2$ crystals are transferred to a metathesis tank. Here the $Na_3H(SO_4)_2$ is separated into its Na_2SO_4 and H_2SO_4 components. The metathesis tank slurry is pumped to a second salt cake filter where the neutral Na_2SO_4 crystals are removed and sent to the mill's recovery system. The filtrate from the second filter, containing the H_2SO_4 to be recovered, is discharged back to the SVP generator.

Other SVP processes

SVP-HP

The SVP-HP process is based on use of hydrogen peroxide (H_2O_2) for reduction of sodium chlorate ($NaClO_3$) in an acidic sulfuric acid (H_2SO_4) solution to form ClO_2. By-products are Na_2SO_4 or $Na_3H(SO_4)_2$ and oxygen (O_2).

SVP Standard

$NaClO_3$ is reacted with sodium chloride (NaCl) in a H_2SO_4 solution to form ClO_2 and Cl_2. The salt cake by-product consists of neutral Na_2SO_4.

SVP Partial HCl

In this process, $NaClO_3$ is reacted with NaCl and hydrochloric acid (HCl) in a H_2SO_4 solution to form ClO_2 and Cl_2. This will give a substantial reduction in by-product Na_2SO_4 compared to SVP Standard.

SVP Total HCl

$NaClO_3$ is reacted with HCl, which acts as both a reducing agent and an acid. NaCl is produced as a by-product.

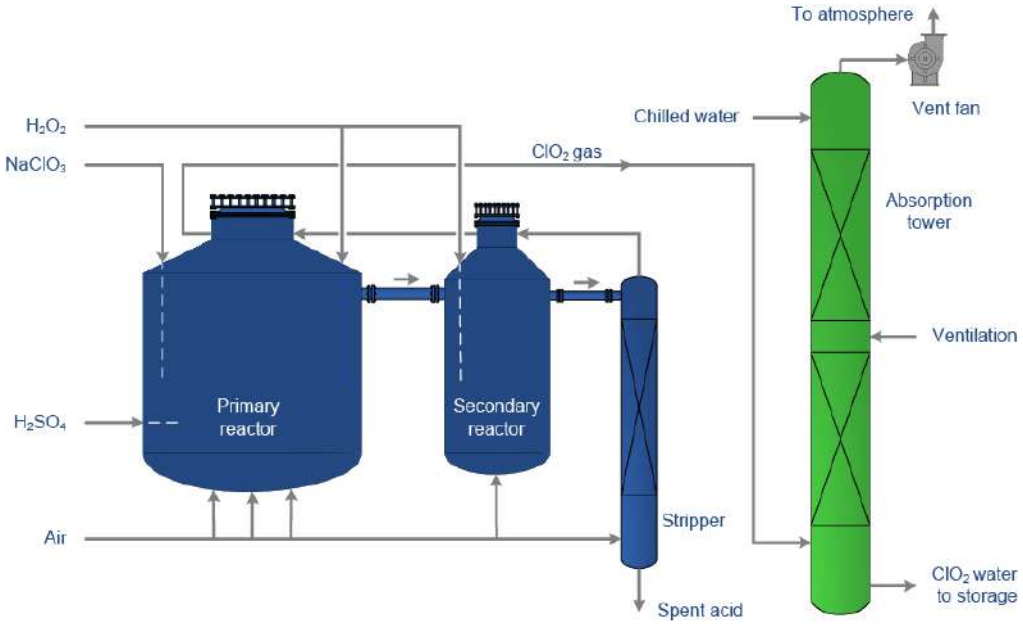
HP-A ClO_2 process

The HP-A is one of the newest processes introduced by Nouryon. This proprietary technology has several advantages over earlier atmospheric chlorine dioxide (ClO_2) processes.

HP-A chemistry

Sodium chlorate ($NaClO_3$) reacts in a two-stage reactor system with a proprietary grade of hydrogen peroxide (H_2O_2) in sulfuric acid (H_2SO_4) solution to produce ClO_2. The reaction by-products are oxygen (O_2) and spent acid containing sodium bisulfate ($NaHSO_4$).

The HP-A process offers the customer the opportunity to expand ClO_2 production capacity with the existing generator. The older atmospheric ClO_2 processes use other reducing agents. Some of the reducing agents contain sodium chloride (NaCl) and then form chlorine gas (Cl_2) as a by-product. Sulfur dioxide (SO_2) and methanol (CH_3OH) are also used as reducing agents.



You normally need the following systems in association with the chlorine dioxide (ClO_2) equipment:

- Chlorate, acid and reducing agent storage and delivery
- ClO_2 product storage and delivery
- Chilled water supply

Our extensive experience in this field has enabled us to become experts in the design and installation of customized systems.

World-class service and spare parts. We offer the following service and support:

Optimization

- Assessment of chemical yield on sodium chlorate, reducing agent and acid
- Chlorine dioxide production capacity tests
- Saltcake removal & utilization
- Vent system emissions recovery
- Investigations of emissions to both air and sewers
- Advanced process control implementation

Operational Support

- Advanced process control consultation
- Remote or on-site troubleshooting
- Applied Kepner-Tregoe methods
- Root cause analysis
- Maintenance planning assistance
- 24 - 7 availability
- Inspection and advice on sodium chlorate, sulfuric acid, methanol, hydrogen peroxide and chlorine dioxide storage
- Investigations of process and production limitations in the chlorine dioxide plant

Process safety

- Participation in safety audits and risk analysis at the chlorine dioxide plant
- Interlock checkouts for Process Safety Management (PSM) program
- Process Hazard Analysis (PHA) re-validation for methanol, chlorine dioxide, turpentine, ammonia and non-condensable gas (NCG) systems
- Supporting documentation / process safety information / Management of Change (MOC) process verification
- PHA Facilitation & OEM Process Expert

Training

- Operator training
- Safety training
- Laboratory analysis

Spare parts

- Our spare parts service will help ensure your plant availability is maximized and any downtime is minimized.
- We deliver all parts rapidly and reliably using our extensive supply chain and global logistics network.
- For quality assurance, we deliver spare parts from the original supplier whenever possible. Some typical spare parts we provide include pump parts, instruments, valves, and filter inserts.

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Nouryon

About Nouryon

Nouryon is a global, specialty chemicals leader. Markets and consumers worldwide rely on our essential solutions to manufacture everyday products, such as personal care, cleaning goods, paints and coatings, agriculture and food, pharmaceuticals, and building products. Furthermore, the dedication of more than 7,900 employees with a shared commitment to our customers, business growth, safety, sustainability and innovation has resulted in a consistently strong financial performance. We operate in over 80 countries around the world with a portfolio of industry-leading brands. Visit our website and follow us Nouryon and on LinkedIn.

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Nouryon's Eka Technologies
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