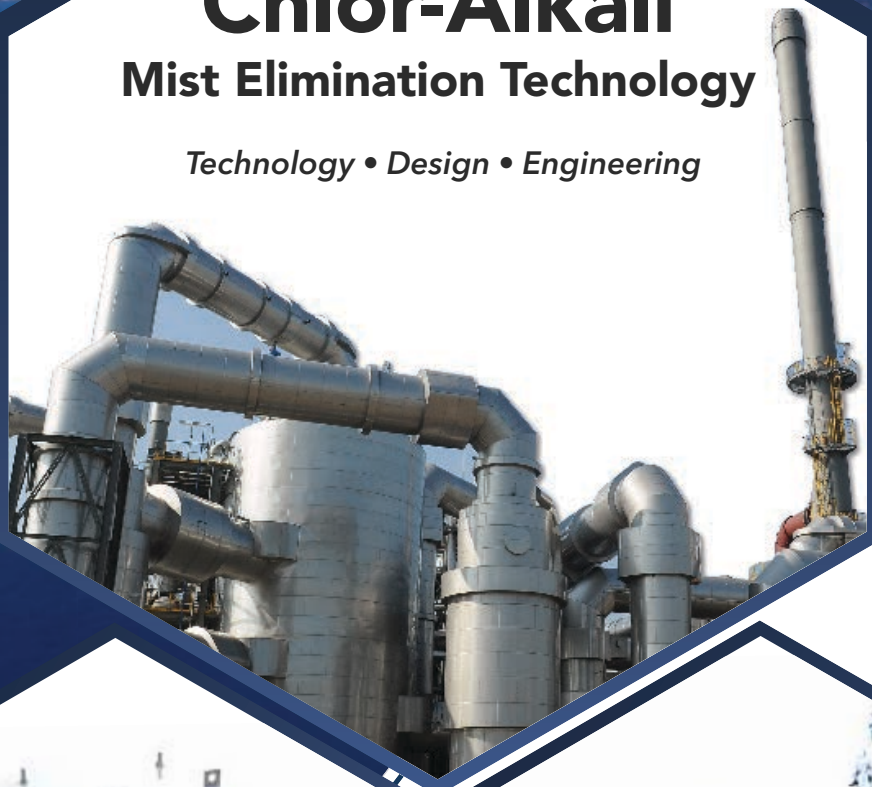
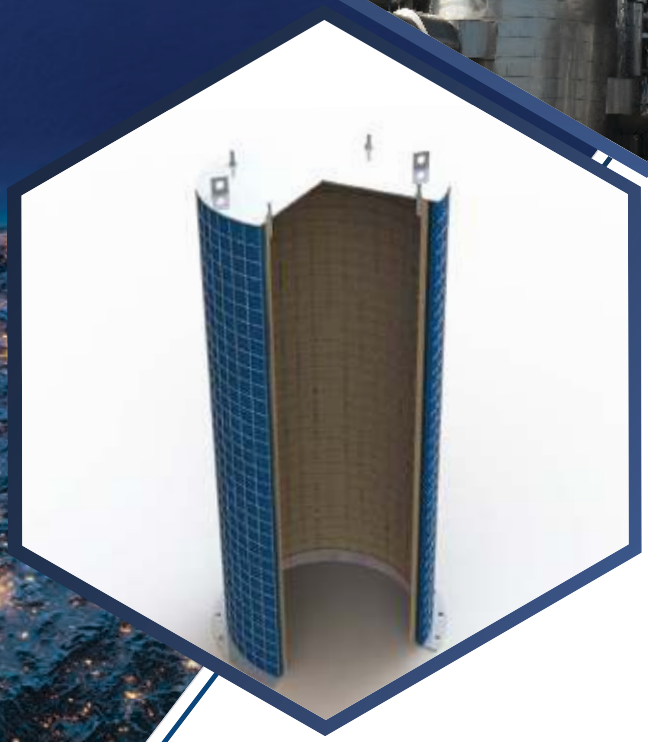
Chlor-Alkali

Mist Elimination Technology

Technology • Design • Engineering





CECO Filters

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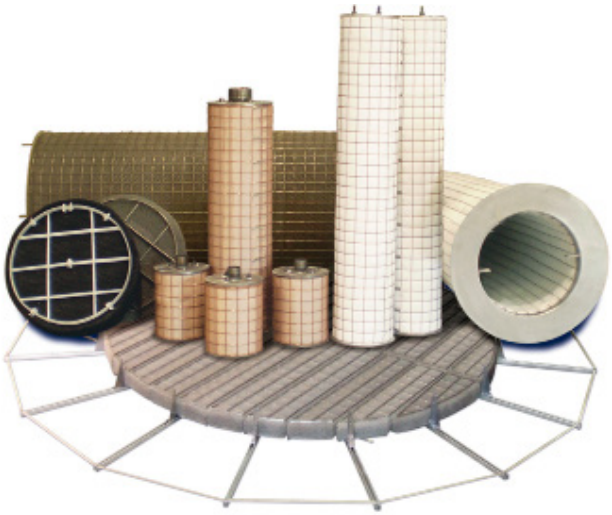
CECO Filters designs and manufactures fiber bed mist eliminators (candle filters) and mesh pad mist eliminators that are used in droplet removal applications. We have more than 50 years of droplet separation / mist elimination experience in the Chlor-Alkali Industry. We are committed to delivering solutions to meet our customers' requirements, while optimizing their performance and efficiency. Our expertise ranges from design, manufacturing, installation and field services.

Our mist eliminators can be custom-designed and manufactured to meet even the most complex requirements of new installations, or to retro-fit existing installations. Our repacking services, consultancy, and testing provide you with added value to optimize your total cost of ownership throughout the life of your equipment.

Our aim is to deliver to our clients a complete solution. Our in-house manufacturing facilities are operated to the highest quality control and manufacturing standards. Upon completion of assembly, each filter is tested for pressure differential through the media to ensure that performance parameters will be met.

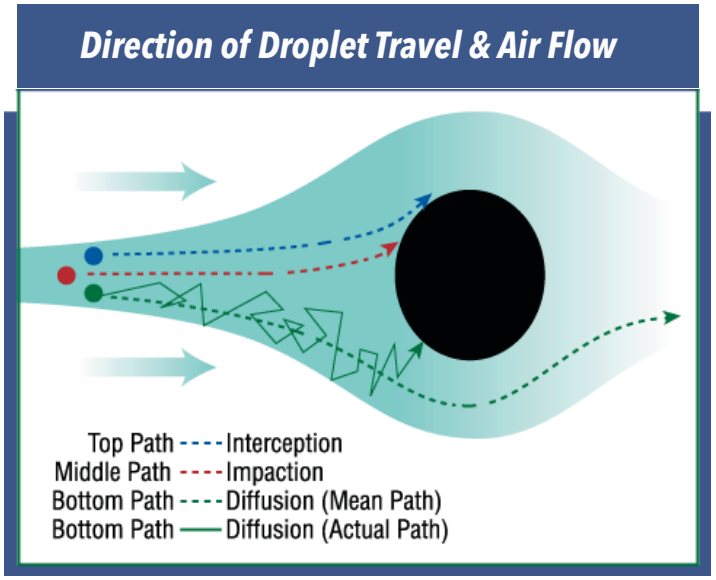


How is mist (droplets) created?

Droplet formation via chemical reaction:
When two or more gaseous components react, they can instantly form very small liquid droplets (less than 1 micron) which are difficult to separate from the carrying gas stream.

Droplet formation via thermal change:
Sub-micron droplets (less than 1 micron) are formed by sudden condensation of saturated gas to liquid.

Droplet formation via mechanical action:
Droplets are formed by mechanical shearing of liquids and gas. These types of droplets are normally above 2 micron in diameter.



Droplet Collection Mechanisms

Droplets within a gas stream are collected within the mist eliminator by a combination of mechanisms: impaction, interception and Brownian Diffusion. The droplets are directed through the mist eliminator with the gas. The droplets are removed by contacting fibers or wire media through the following collection mechanisms:

Impaction

Droplets larger than 2 micron in diameter move along with the gas stream until the droplet comes to an obstacle such as a fiber in the filter media. The gas stream flows around the fiber and the large diameter droplet, controlled by its momentum, continues its original trajectory and "impacts" onto the fiber.

Interception

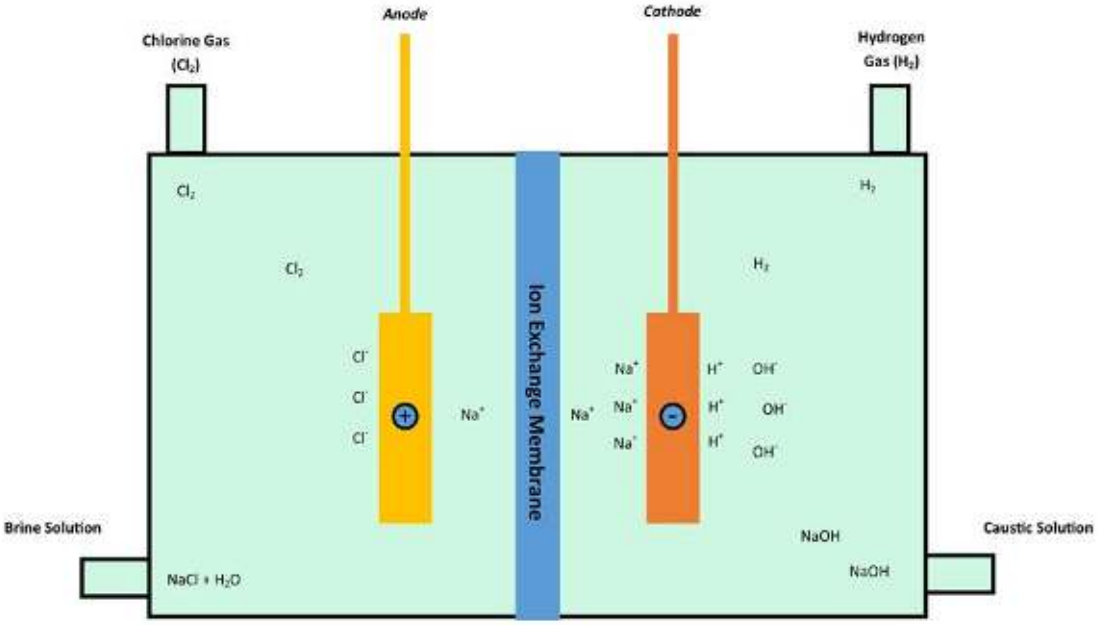
Smaller droplets of 0.5-3 microns are collected by interception. The droplet has less momentum, and the center of gravity path goes in the same direction as the gas, around the fiber. However, the droplet has a finite diameter, and the edge of the droplet is "intercepted" by one or more fibers and is collected.

Brownian Diffusion

Sub-micron mist droplets have very little mass and little momentum, so the mean path of these droplets follows the gas stream around the fiber. However, the sub-micron particle movement mimics the random movement of a gas molecule (Brownian Motion) causing deviations away from the mean stream. With a given fiber diameter, residence time, gas velocity, bed depth, and packing density, these deviations cause the sub-micron droplet to collide with the fiber and be collected.

Chlor-Alkali Industry

Chlorine, Caustic and Hydrogen can be produced using electrolysis on common salts such as Sodium Chloride and Potassium Chloride. The type of electrolysis can take place in either a mercury or diaphragm cell divided by a membrane. Brine is extracted via Anode and Cathode cells on either side of the membrane.

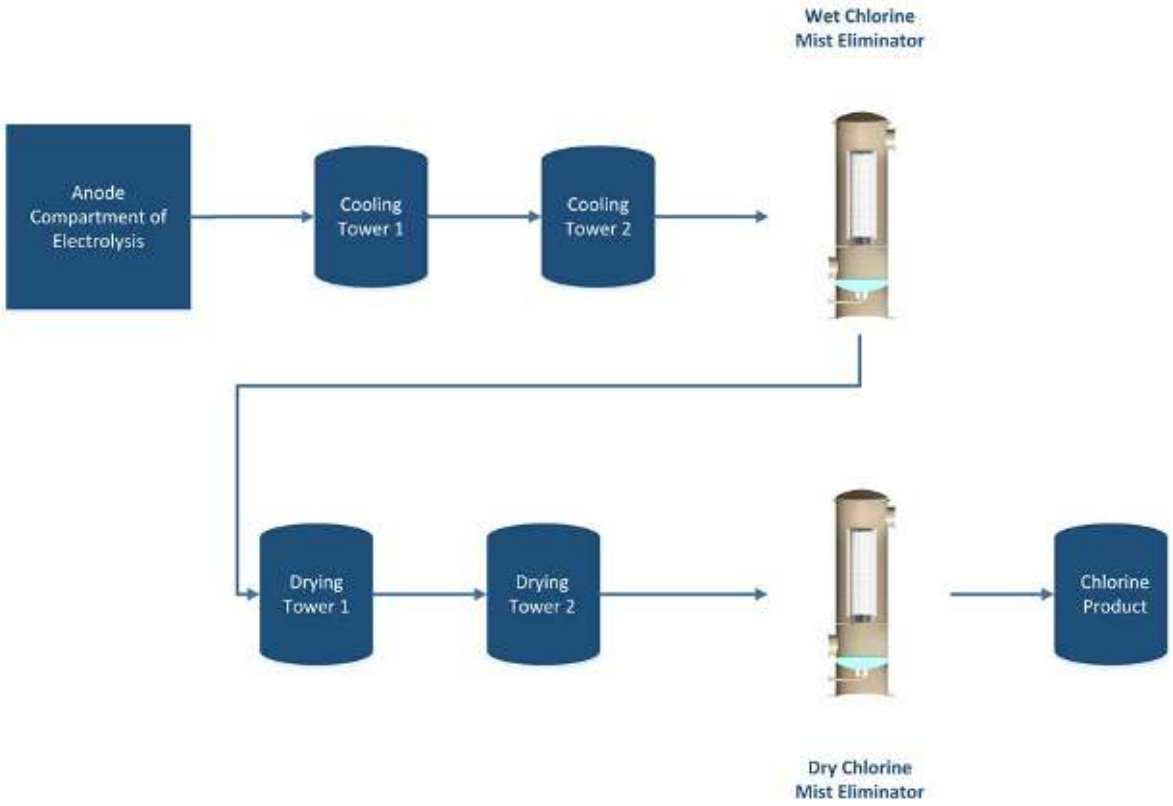


Mist Elimination Applications

Our in-house experience of Chlor-Alkali plant technologies allows us to clearly tailor the optimized mist elimination solutions to all our new and existing customers. Our range of equipment can be used for a wide spectrum of Chlor-Alkali mist elimination applications.

- *Wet Chlorine*
- *Dry Chlorine*
- *Hydrogen*

Wet and Dry Chlorine Applications



Wet Chlorine

Chlorine gas is recovered from the output of the Anode cell along with water and Sodium Chloride (soluble in water). The fluid undergoes continuous cooling in a heat exchanger to reduce the water content of the chlorine gas mixture. The shock cooling in the heat exchangers creates fine submicron mist which require removal.

Benefits of removing process mist?

- Optimizes production
- Lowers the concentration of water and limits water/moisture carry over.
- Reduces Sulfuric Acid consumption, in downstream drying tower application.
- Prevents corrosion and formation of Hydrochloric Acid (HCl) from in dry chlorine process (NaCl reacting with H_2SO_4).
- Minimizes Sodium Sulphate formation in dry chlorine application.
- Prevents solid blockage by removing aqueous Sodium Chloride (NaCl) solution.
- Removal of chloride hydrocarbons
- Fouling rate of coolers is significantly lowered
- Protects downstream compressors
- Reduces energy consumption of the operation
- Increase product purity
- Optimized plant capacity
- Less maintenance and operational costs

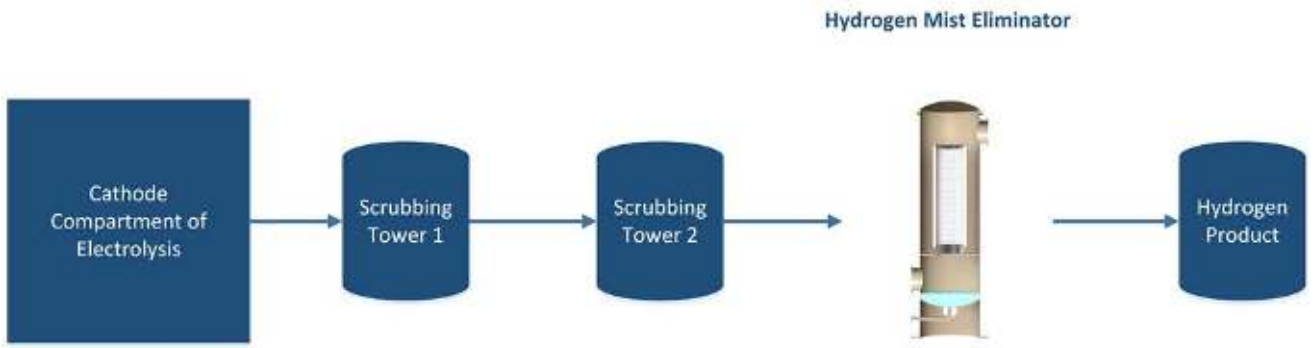
Dry Chlorine

The recovered chlorine gas from the wet chlorine application will contain moisture. Sulfuric acid is used to remove this moisture in the drying tower. During this process, fine sub-micron mist is created in the gas stream and passes into the dry chlorine mist eliminator.

Benefits of removing process mist?

- Prevent corrosion and damage to downstream compressor from Sulfuric Acid carry-over
- Minimize formation of chlorine hydrate and hydrous iron chloride
- Eradicates Sulfuric Acid liquification and maintains maximum heat transfer in downstream heat exchanger
- Reduced Sulfuric Acid consumption and loss prevention of Sulphuric acid liqueur
- Higher product purity
- Low Cost Solution

Hydrogen Application



Hydrogen

In the cathode compartment, the electrode is submersed in Sodium Hydroxide (NaOH) solution. Hydrogen bubbles are generated on the cathode surface upon contact. The hydrogen gas bubbles reach the surface of the solution where solution is entrained onto the hydrogen to create mist droplets at the exit of the cathode compartment. A scrubbing unit is used to remove the larger droplets and water soluble gaseous components from the hydrogen gas stream. Following the scrubber, a mist eliminator is used to remove the fine droplets which passed from the scrubber unit. Following this the clean/dry Hydrogen gas is directed to storage from the mist eliminator unit.

Benefits of removing process mist?

- Higher product purity
- Prevents caustic carryover
- Eradicates or reduces fouling of hydrogen burners for fuel source for hydrogen energy generation
- Protects downstream equipment such as compressors and storage tanks.
- Prolongs active carbon system for mercury removal

Hanging Candle

Standing Candle

Chlor-Alkali Solutions/Selection			
Description	**Wet Chlorine**	**Dry Chlorine**	**Hydrogen**
Fiber Bed Media Material	Glass Fiber or Polyester	Glass Fiber	Polypropylene
Structure Material	GRP/FRP or Titanium	316L Stainless Steel	316L Stainless Steel
Orientation	Standing or Hanging	Standing or Hanging	Standing or Hanging

Performance (Brownian Diffusion)		
Media Type	**Typical Efficiency**	**Pressure Drop [1]**
P1	100% >0.6µm >99% >0.2µm	1.7-2.5 kPa 6.8-10 inwc
P2	100% >0.9µm >99% >0.5µm	1.3-2.0 kPa 5.2-8.0 inwc

[1] Clean and saturated at max velocity and 1000 mg/NCM liquid loading

-R Media Type suffix specifies that rope fiber is part of the fiber material configuration

CECO Filters

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Excellence in Pollution Control Technology, Service and Support Worldwide

CECO Filters' focus on unsurpassed customer service and innovative filter designs for the Chlor-Alkali Industry has earned us a reputation as an industry leader, providing cutting edge technology solutions for the past 5 decades. CECO Filters are designed to create cleaner processing and safer environment.

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