ClorDiSys

"The Chlorine Dioxide People"

Application Note #63

Can Carbon be used to scrub Chlorine Dioxide Gas?

Yes, carbon can be utilized to remove chlorine dioxide (CD) from any exhaust stream. Most CD gas is exhausted to the outside environment. All local, state and federal regulations must be followed. For example, the bay area of California allows 23lbs (10.4 kg) per year to be released to the outside environment.[1] This quantity (23 lbs.) will allow a 300 ft^3 (8.5 m^3) chamber to exhaust a 5mg/L cycle 245 times per year. At a concentration of 1mg/L, the cycle can be exhausted 1229 times. If exhausting is not allowed, scrubbing devices can be utilized to filter out the CD from the exhaust stream.

Scrubbers can be as simple as carbon and as complex as sodium thiosulfate counter current scrubbers. Both scrubbers pass the CD gas/air mixture through the carbon or through a mist of sodium thiosulfate sprayed downwards and the CD gas / air mixture is flowing upwards. For vacuum applications where a liquid (water) ring pump is utilized, the CD gas / water mixture is flowed over a carbon bed which removes the CD gas from the water before the water is dumped down the drain. For vacuum applications utilizing a rotary vane vacuum pump, the exhaust from the pump passes through the normal CD/gas/air mixture scrubber removing the CD gas from the exhaust air. All of these types of scrubbers are 100% efficient with a single pass and do not require a recirculating system.

Studies done by the US-EPA show that the simple activated carbons (not impregnated or containing other activated sorbent materials) were the most effective at removing CD gas from air streams. Tests demonstrated a maximum adsorption capacity of approximately 110 mg of CD gas for each gram of carbon (100mg/g).[2]

ClorDiSys Solutions, Inc (CSI) has a myriad of carbon-based scrubbers based upon the application and size of the chamber. CSI carbon scrubbers are 100% efficient at removing CD gas from the air or water steam.

Air Scrubbers for Room / Chamber

In figure 1 are 3 scrubbers for removing CD gas from the air. These scrubbers take in CD gas / air mixture from the bottom and this mixture passes through a bed of carbon pellets to remove the CD gas. The pellets are simply activated carbon (not impregnated with anything) with a particle size diameter of 4.0mm and a length of 6mm. This pelletized version allows for good airflow through the carbon bed. Enough carbon is in each carbon box / bed to make it 100% efficient at removing the CD gas. The carbon is virgin activated carbon. Derived from bituminous coal. Its high activity and surface area make it ideal for most gas phase applications. The uniformity of its shape makes it particularly attractive in applications where low-pressure drop is a consideration for high air flows.

Figure 1: examples of CD gas air scrubbers. BSC (left), room (middle), larger room (right). the room scrubbers typically remain in the room, but can be configured to be outside the room if necessary.

Vacuum Scrubbers for Vacuum Pumps

For vacuum systems there are 2 types of vacuum pumps used to remove the CD gas. One is a liquid ring vacuum pump that uses a water stream to remove the CD gas and the second is an oil rotary vane that exhausts the gas to the outside environment. For the liquid water ring pump the CD gas must then be removed from the water steam. This is done by flowing the water outlet from the pump over a drum of carbon pellets or grains before the water stream flows into the drain. For oil seal vacuum pumps a normal air scrubber connected to the pump exhaust can be utilized.

References

[1] Bay Area Air Quality Management District (BAAQMD) Regulation 2, Permits Rule 5, New Source Review of Toxic Air Contaminants, accessed on Jan 18, 2021, https://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Rules%20and%20Regs/reg%2002/rg0205.ashx?la=en

[2] Wood, J.P., Ryan, S.P., Snyder E.G., Serre, S.D., Touati A. and Clayton M.J., Adsorption of Chlorine Dioxide Gas on Activated Carbons, Air & Waste Manage. Assoc. Aug 2010, 60:898–906.