LANTEC

Visit us on the World Wide Web!
http://www.lantecp.com

H_2S (Hydrogen Sulfide – Sewer Gas) Odor Control Wet Scrubber Design and Chemical Consumption Using Q-PAC®

Background

Sewer gas, chemical name hydrogen sulfide, H_2S, is a common source of odor complaints around waste water treatment plants. At low concentrations of 10 ~ 50 ppm_v it is source of 'rotten egg' odors associated with treatment plants. It has a very low odor threshhold of 0.3 ppm_v. Hydrogen sulfide is also dangerous, at 100 ppm_v loss of eyesight will occur and at 300 ppm_v the gas is at lethal concentration. And in addition to being a nusciance at low concentrations and dangerous at higher concentration, exposure to H_2S between 50 – 100 ppm_v can not be detected by smell as at this concentration level it causes one's olfactory organs in the nose to fail.

H_2S Control – Traditional Wet Scrubbing using Chemicals

The most common method of control of H_2S gas is to pass the smelly gas through a vertical, packed bed wet scrubber. The air passes up the tower as the scrubbing liquid containing caustic (NaOH) and oxidizing agent (most often bleach or NaOCl, sodium hypochlorite) flows down the tower in counter-current fashion. The high pH provided by the caustic drives the mass transfer from gas to liquid phase by solubolizing H_2S as HS^- bisulfide and S^{-2} sulfide ions. Once in solution, the reaction between hydrogen sulfide and oxidzing agent is almost instantaneous (assuming sufficient oxidizing agent is present). This reaction converts the sulfide to sulfate (SO_4^{-2}) ion. The overall chemical reaction is described by the following equation:

$$H_2S + 4NaOCl + 2NaOH \rightarrow Na_2SO_4 + 4NaCl + 2H_2O$$

Therefore, theoretically, for each molecule of H_2S destroyed, four molecules of bleach and two molecules of caustic are consumed. However, the chemistry is not quite so simple, as partial oxidation of H_2S also takes place which forms elemental sulfur:

$$H_2S + NaOCl \rightarrow NaCl + H_2O + S\downarrow$$

Two stage H_2S odor control scrubbing system.

This reaction represents about 1% of the chemistry present in a wet scrubber. The presence of excess bleach helps to minimize the formation of elmental sulfur. But bleach is an expensive chemical. The use of two stage scrubbing is often employed both to minimize chemcial consumption as well as to control sulfur deposits when scrubbing H_2S. The first stage operates at~ 80% efficiency and uses a caustic only scrub at high pH (~ 12.5). The air then passes to the second stage, where the remaining H_2S is scrubbed with caustic / bleach solution at pH ~ 9.5. The H_2S present is destroyed at 99%+ efficiency. The blowdown from the 2nd stage, which will contain some amount of unsued NaOCl, is sent to the sump of the 1st stage. In this way additional H_2S is destroyed and maximum consumption of expensive oxidizing agent is assured.

Never the less, there are losses of chemicals which can not be prevented, which of course raise the cost of odor control scrubbing. These losses are due to the facts that bleach, NaOCl, slowly decomposes in storage as well as the fact that some amount of caustic is constantly lost to CO_2 absorption in both scrubbing stages.

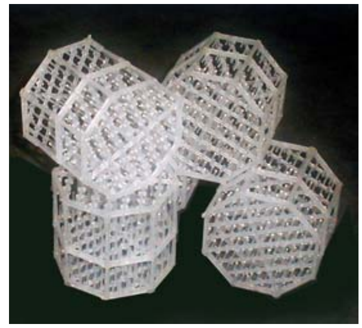
LANTEC

Visit us on the World Wide Web!
http://www.lantecp.com

Q-PAC for H_2S Odor Control Scrubbers

Introduced to the industry in 1996, ***Q-PAC*** offers a number of advantages when designing an odor control wet scrubbing system:

Very Low Pressure Drop = Low Operational Expense
Very High Efficiency = Effective Odor Control
High Design Velocity = Reduced Chemical Losses
High Void Fraction, All Rounded Design = Resistance to Fouling
Self Cleaning Design = Reduced Maintenance, Long ServiceLife



Q-PAC®
US Patent #5,458,817

Design Example – 50,000 cfm, 99%+ Efficiency
Typical Two Stage Odor Control System Using Q-PAC

Air Flow = 50,000 cfm
Temperature = 80 ºF
H_2S Inlet Concentration = 35 ppm_v
CO_2 Concentration = ambient 370 ppm_v
Tower Diameters = 10 ft
Superficial Gas Velocity = 637 fpm

First Stage

~ 90% H_2S Efficiency
Packing = 6 ft ***Q-PAC***
Liquid Flow = 300 gpm
Sump pH ~ 12.5
Q-PAC Pressure Drop = 1.1 in W.C.
Caustic Strenght = 50%
Theroretical Caustic Consumption = 15.4 gal/hr

Q-PAC®
Random Dumped Into Odor Control Scrubber

Second Stage

99%+ H_2S Efficiency
Packing = 10 ft ***Q-PAC®***
Liquid Flow = 300 gpm
Sump pH ~ 9.5
Oxidative / Reduction Potential ~ 600 mV
Q-PAC Pressure Drop = 1.9 in W.C.
Caustic Strength = 50%
Theroretical Caustic Consumption = 9.1 gal/hr
Bleach Strength = 12.5%
Theoretical Bleach Consumption = 2.1 gal/hr

Note:
This discussion is for general informational purposes only. No warranty is implied or granted with this design example. Please contact Lantec Products to review the design needs of your specific project. All packing supplied to a given project is sold with a performance warranty when the design for that project was supplied by Lantec Products.

sales@lantecp.com