GASBLASTER Application Overview

The treatment and transfer of wastewater produces odor emissions what are sometimes disturbing for the population living nearby a waste treatment facility or pumping station. The main sources of bad odors are sludge and its treatment as well as the collecting and primary treatment stages. The measurement of odors and the tolerance threshold of bad smells are subjective and no legislation about it has been made. Nevertheless wastewater plant managers try to limit the emission of odors. The two main sources of nauseous odors are H2S and NH3.

To aid in the removal of these odors, Enchlor Inc. has developed the Gasblaster Series of Ozone generators specifically designed to remove these odors. The Gasblaster prevents these odors from escaping the treatment or transfer chamber by injecting high concentrations of ozone into the air above the wastewater providing destruction of the offending gaseous odors and reducing them to simple compounds that simply return to the wastewater for disinfection.

Direct Ozonation

Two methods are available to control the odors related to wastewater facilities and treatment, the simplest one is the direct ozonation. This method is suitable for small plants and can be relatively inexpensive. The alternative is washing the air with ozonized water. This last method is more complex and reserved to large plants.

The method of elimination of odors by direct ozonation consists in putting in contact ozone molecules (O3) and nauseous molecules (H2S, NH3 and CH4). Those last compounds are mainly reducers whereas ozone is a strong oxidant, consequently they react so that the ozone molecule looses an oxygen atom and an oxygen molecule (O2) is released. At the same time the addition of an oxygen atom to the odorous compound provokes it to break up into smaller compounds or to transform into a stable compound. Those new molecules are not odorous.

Concerning hydrogen sulphide two ways of reaction are possible:

H2S + O3 = H2O + S + O2 (principal reaction)

H2S + O3 = H2O + SO2 (secondary reaction)

Obviously the principal reaction is environmentally more interesting since the secondary reaction releases sulphur dioxide (SO2) that belongs to the family of sulphur oxide gases (SOx). SO2 dissolves in water vapor to form acid, and interacts with other gases and particles in the air to form sulphates and other products that can be harmful to people and their environment.

Ammonia and methane also react with ozone and gives stable products (carbon dioxide and nitrogen gas):

$CH_4 + 4O_3 = CO_2 + 4H_2O + O_2$

$4NH_3 + 3O_3 = N_2 + 3H_2O + 3O_2$

These reactions gives water (H_2O), oxygen (O_2), carbon dioxide (CO_2) and nitrogen (N_2). There are all stable molecules and do not have harmful or nauseous effects.

Five parameters have to be taken into account in order to design a proper ozonation process:

1. Concentration of the nauseous molecules
2. Temperature and moisture
3. Type of contact between the gas and the ozone
4. Contact time between the gas and the ozone
5. Volume to be treated and flow of air

Ozonation can as well remove totally the odors as reduce them at a suitable level. Generally if the ratio ozone molecule by hydrogen sulphide molecule (O_3: H_2S) is comprised between 1.5 and 2, it is enough to obtain a sufficient result. Nevertheless a ratio of 2 permits to prevent from peaks.

Higher quantity of ozone can be used in case of difficult conditions (such as high temperature and high moisture content). It can also be required for highly concentrated odorous compounds, especially when treating the sludge.

The installation of the ozone generator is also important. The ozone reacts better when injected into a warm and wet medium, but its production by the generator is the best when it occurs in a dry and fresh place. Then the generator uses to be installed outside or a least not at the same place where the reaction happens.

As mentioned before the contact surface between the ozone and the nauseous gas is critical for the process. This is reinforced by the fact that the concentrations of hydrogen sulphide are only around a few ppm. Two possibilities are proposed to achieve this contact:

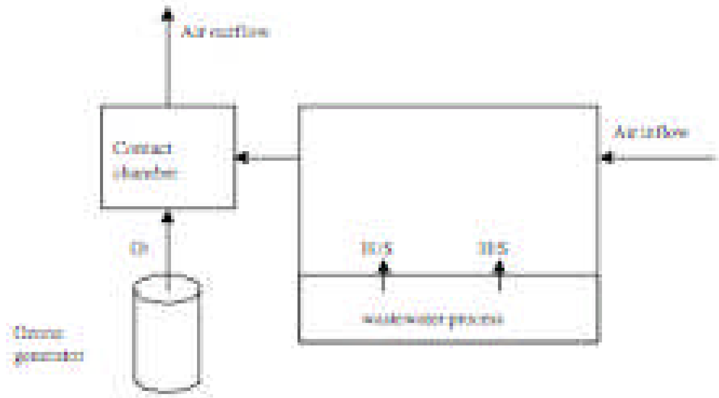

Figure 1. Direct ozonation with contact chamber.

The ozone is injected into the aerating system before the air is released outside. The contact time has to be enough long so that the molecules will interact. Some reactions occur very quickly, but the minimum contact time is 10 to 15 seconds. When possible, it is recommended to increase this contact time to 30-40 seconds.

The reaction happens in a contact a “mixing-chamber” (or contact-chamber). Its volume is computed with the flow of air and the desired contact time. In case of short contact times, it is recommended to increase the ozone concentration. Nevertheless one has to be very careful to not oversize the installation because of the risk ozone emission to the air. If it happens anyway an ozone destructor has to be installed at the outflow of treated air (example: thermo catalytic unit or UV treatment).

The second risk of an excessive ozone concentration occurs when added to a too long contact time. The consequence is the production of sulphur trioxide (SO3). In the shape of gas sulphur trioxide is irritating and harmful (mainly produced by the combustion of hydrocarbons). Nevertheless the sulphur trioxide generated in this process can also be combined with the water and then forms sulphuric acid (H2SO4), a very corrosive and harmful substance.

The advantage of this solution is that the treated room remains accessible for the worker since no ozone is released. Nevertheless an ozone detector is needed to secure the work conditions (ozone is an irritating gas that affects the breathing system of humans).

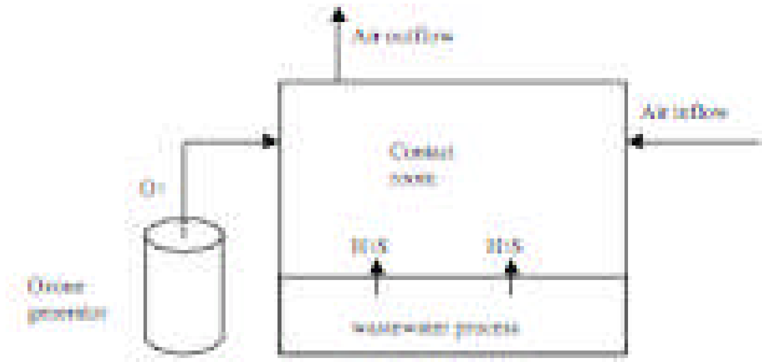

Figure 2. Direct ozonation without contact chamber.

The second possibility is to flow the ozone in the incoming air. Then the room becomes the reaction chamber. This system is particularly convenient when the odor is very local, especially during the primary treatment (grit, storage vat). The design of this process requires considering the same parameters as for the first system (concentration of nauseous substances, volume of the room, flow of air and retention time). The disadvantage is that the room is not accessible when the generator is working. When an operator accesses the room, it has to be checked by a detector that the concentration of ozone has decreased until 0.1 ppm.

Safety Issues of high Hydrogen Sulfide Levels

Hydrogen sulfide levels are an indication of the aggressiveness of the atmosphere. This situation greatly increases the rate at which corrosion occurs inside the wet well. Severe corrosion damage can be expected at stations with high Hydrogen sulfide levels and without effective protection these stations can quickly be considered to be structurally compromised to the point where repairs are required or operator safety is compromised. This corrosion produces conditions, which are considered unsafe for manned entry into a wet well. These conditions included failed access ladders, corroded/disintegrated handrails, access platforms with missing sections of grating etc.

The Gasblaster series of control units provides valuable benefits in both odor control and a reduction in corrosion to facility equipment from the reduction and removal of H2S. For additional information and system details, please contact your local Enchlor Inc. representative.

Enchlor Inc. GASBLASTER
PO Box 77
130 West Main Street
Silverdale, PA 18962
Phone: (215) 453-2533
www.enchlor.com