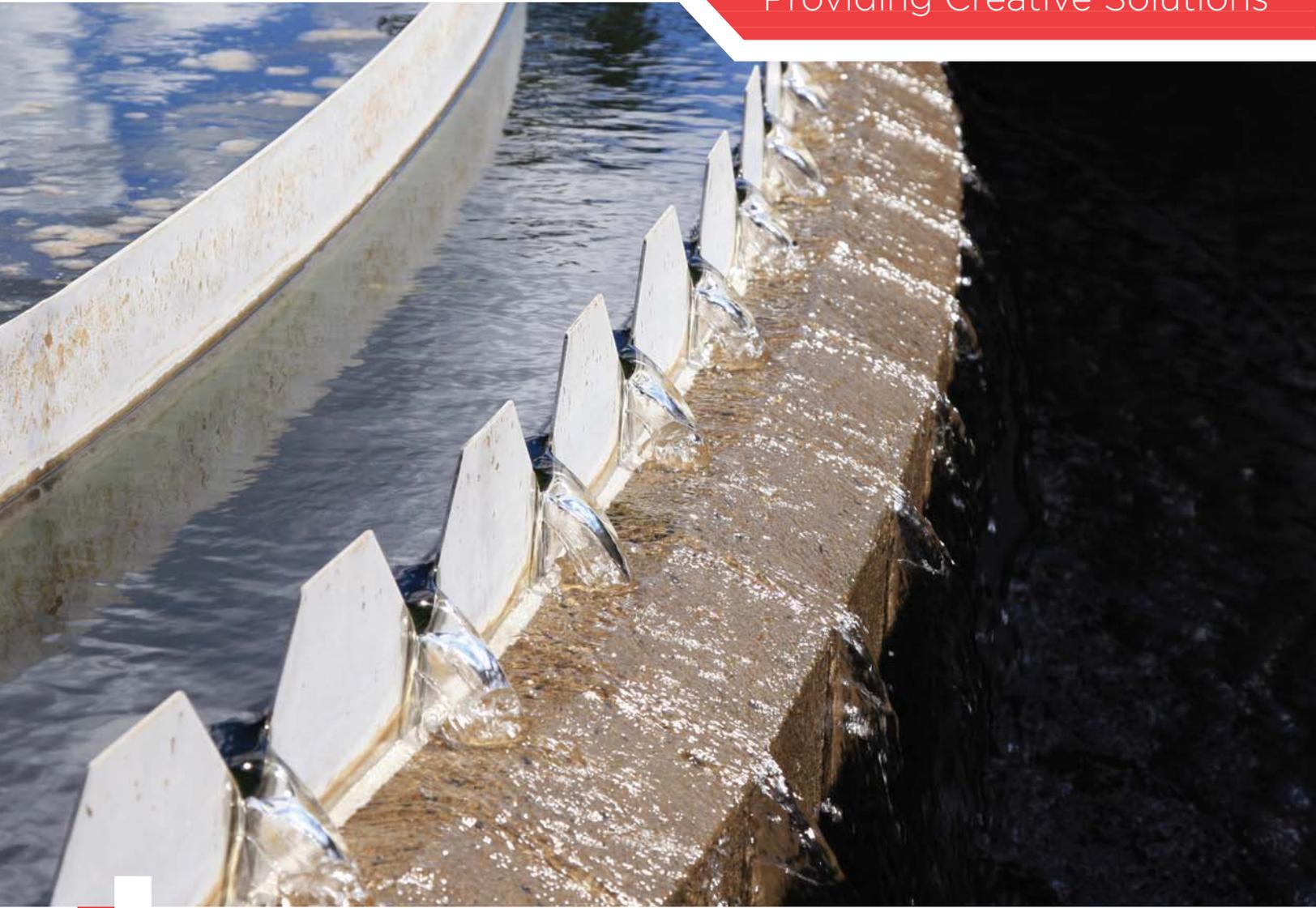


Providing Creative Solutions



Hydritreat HS Process



Hydrite Chemical Co. has been utilizing the Hydritreat HS process since 2005 to eliminate odors that were previously untreatable as well as reducing costs for more traditional sulfide treatment programs. Our customers look to us to bring new technologies and process improvements to their critical areas of operations.

To meet this end, Hydrite operates two separate technical services and development facilities as well as funding research efforts at universities and industry research centers. It is this focus on improved chemistry and process improvement that separates Hydrite Chemical Co. from our competitors. We appreciate that eliminating odor is neither glamorous nor is it profitable for you. Many odor issues involve complaints from the general public who have very little patience remaining by the time Hydrite becomes involved. In other circumstances employee health and safety is an issue. The bottom line is that we are thrust into difficult situations with the expectations of making problems go away.

Hydrite Chemical Co. welcomes these opportunities. We have successfully solved high profile odor complaint cases, providing support to our customers in public arenas. We stress being proactive in controlling odors before they reach this stage, staying ahead of issues rather than playing catch up. We are presented with new and challenging odor cases from a wide customer base including municipalities, food processors, paper mills, and industrial accounts. If you do not see your specific odor issue, bring it directly to our attention. If we can't help, we will tell you up-front. If we are unable to provide the solution, we will try to connect you to someone who can.



ABSTRACT

Hydrite Chemical has identified a rapid chemical treatment method for control of odors associated with waste water collection systems, waste water treatment, and sludge dewatering/storage. The Hydritreat HS Process has been demonstrated to remove > 98% of the volatile organic sulfur compounds and sulfide within waste water and sludge. Importantly, the method can be applied in-line as the waste water or sludge enters a given facility with little or no capital improvement. Results have consistently demonstrated nearly complete control of hydrogen sulfide within facilities to < 5 ppm in the air. The Hydritreat HS process utilizes a proprietary activator along with an oxidant to form potent hydroxyl radicals which in turn destroy a wide range of odor causing compounds. These radicals allow for the destruction of odorous compounds in as little as three to five minutes of contact time.

Hydritreat HS Process

FREE RADICAL FORMATION

The Hydritreat HS (H-HS) process is an oxidation process utilizing the formation of free radicals as a means to destroy specific odor causing compounds. These free radicals are formed by combining a range of oxidants and our proprietary organo-metallic catalysts (Hydritreat HS C or Hydritreat HS CF) into the odor causing stream. Most commonly a peroxide solution platform is used with the catalysts to generate hydroxyl radicals. Hydroxyl radicals have a significantly higher oxidation potential than nearly every commercially viable oxidant (TABLE 1). The elevated oxidation potential of the hydroxyl radical allows us to overcome traditional shortcomings of most oxidation processes, especially overcoming high COD/BOD loadings in sludge and industrial source waste water.

TABLE 1. Relative Oxidation Potential of Select Oxidants. Chlorine Basis. (source: http://www.epa.gov/oust/pubs/tum_ch13.pdf)

OXIDANT	RELATIVE OXIDATION	POTENTIAL
Hydroxyl Radical		2.05
Ozone		1.5
Hydrogen Peroxide		1.3
Permanganate		1.2
Chlorine Dioxide		1.1
Chlorine Gas		1.0
Oxygen		0.9
Hypochlorite		0.69

Hydroxyl radicals destroy odor compounds by their very nature. Hydroxyl radicals are defined by the presence of a free, unpaired electron in the outer orbital shell. An unpaired electron is very unstable and wants badly to be paired with another electron. This unpaired electron is quite aggressive and capable of breaking even complex chemical bonds to satisfy the need for electrochemical balance. Compounds susceptible to hydroxyl radicals are very rapidly oxidized. In the case of the most common odor causing compound, hydrogen sulfide (hydrosulfide in solution), it is believed that the hydroxyl radical breaks the hydrogen-sulfur bond, resulting in the immediate formation of water and elemental sulfur. In addition to hydrogen sulfide, the H-HS process is capable of destroying a wide range of odor causing compounds. Destruction of volatile organic sulfur compounds occurs very quickly, usually within 3 to 5 minutes of contact.

EXAMPLES OF TREATABLE ODOR COMPOUNDS

- Hydrosulfide: (hydrogen sulfide liquid phase)
- Thiols (mercaptans): (methane-, ethane-, etc.)
- Volatile fatty acids: (butyric, acetic acid, etc.)
- Carbon disulfide
- Dimethyl sulfide (-disulfide, -trisulfide)



PARAMETERS

The Hydritreat HS (H-HS) process requires three very traditional parameters in order to optimize performance; contact, retention time and pH.

Contact through mixing is typically achieved by taking advantage of equalization basins and bends in piping. Sufficient retention time (1-5 minutes) is achieved in the same manner. In rare occasions we will utilize a slip stream to introduce the process at a higher rate of reaction. The final key parameter for the process is pH. The catalyst triggers most efficiently at a neutral pH (6.5-8.5). Prior to preparing for a trial we ask that you provide us with some key information. This will assist us in maximizing the time of all involved parties.

GENERAL SURVEY INFORMATION

- General flow diagram/description of your process
- Daily flow rates
- Daily run time/flow rate (belt press/dewatering)
- pH of waste water
- Concentration of target compound - ppm (e.g. sulfide levels)
- COD/BOD levels
- Retention time (collection system, clarifier, lagoons, etc.)

The most common application method associated with the Hydritreat HS process is a two part liquid addition that is introduced separately from one another. This necessitates the use of two separate injection pumps. Hydrite has refined this system to our current units which utilize Prominent brand pumps mounted on skids. These skids typically utilize draw down tubes for precise dosing. Given the simplicity of the pump units, any malfunctioning component can be quickly and easily changed out should it fail. This means there is no costly down time associated with the repair of chlorine dioxide or ozone generators. These pumps work on 120 V power, and draw a minimum of electrical current, keeping operating costs to a minimum. Furthermore, more advanced units can be built which allow for 4-20 mA input from monitoring devices such as flow sensors or sulfide monitors. Logic centers can be installed which allow for remote monitoring and adjustment of feed rates, inventory management and real time hydrogen sulfide readings. This approach allows for optimum dosing control which minimizes expenses.

TRIALS AND INSTALLATION

Hydrite Chemical Co. is able to provide consultative technical services. We can assist with specifying and sourcing safe and effective chemical feed equipment. We provide on-site technical support to ensure the chemicals are performing efficiently and effectively.



CASE STUDY

HEADWORKS - RAPID ODOR CONTROL

Odor sources can be organized into five applications; head works, collection systems, sludge/biosolids, pond/lagoon treatment and sludge-cell wall lysing. Regardless of the exact location, these five areas represent treatment methods applicable to a wide range of challenging situations.

Hydritreat products used:

- Oxidant: Hydritreat HS O, HS P, HS P3, HS PNH
- Catalyst System: HS C, HS CF

ISSUE

Many odor issues manifest themselves at municipal wastewater treatment plants (WWTP). Hydrogen sulfide is released in the head works of a WWTP when wastewater leaves the confined space of the collection system and is exposed to the atmosphere. The H-HS process is unique in its rapid control of odors, typically achieved in 3-5 minutes.

In many cases, treatment of odor issues is not possible in the collection system, forcing municipalities to control odors before they are released from the WWTP. Given the tendency of litigation by individuals, many municipalities are forced to treat this odor, but until the H-HS process, did not have the economical means to achieve this goal.

INJECTION POINTS

Splitter Box - The splitter box is an excellent location for introducing the H-HS process. The splitter box provides excellent mixing while the grit settling chamber may provide additional retention time. When odors or corrosion levels are too high in the splitter box complex, it may be necessary to move up the collection system to a manhole.

Manhole within boundary - Given the short reaction time of the H-HS process, manholes within the WWTP boundary line can be utilized to provide added reaction time. This is accomplished by simply installing injection points in the sewer main. This approach also maintains security provided by the WWTP facility.

TABLE 4: HEADWORKS CASE STUDY

Flow Rate	Pre-Treatment	Post-Treatment
8 MSD Headworks, TN	4-5 ppm sulfide/200 + H ₂ S	<0.1 ppm sulfide/0.00 ppm H ₂ S
5.5 MGD Headworks, MN	9.9 ppm	<1.0 ppm
4.6 MGD Wet Well, MO	30 ppm	1 ppm
1.1 MGD Industrial Effluent, WI	20 ppm	2 ppm



CASE STUDY

COLLECTION SYSTEM - LONG TERM ODOR CONTROL

Hydritreat products used:

- Oxidant: HS O, HS P, HS P3, HS PNH, HS X
- Catalyst System: HS C, HS CF, CS 41, CS 11

ISSUE

Sulfide compounds are readily formed in oxygen starved collection systems by biological conversion of sulfate compounds. This conversion occurs as oxygen molecules are stripped from sulfate compounds, eventually reducing the sulfate molecule to sulfide. The sulfide formed from this process can cause significant odor release and lead to costly corrosion of concrete and steel infrastructure.

The Hydritreat CS series (CS 11, CS 41) process is a two-part chemical addition, much like the standard Hydritreat HS process. Hydrite utilizes a proprietary blend of our catalyst and a mild oxidant (Part A) in conjunction with a strong oxidant or oxygen (Part B) to efficiently destroy odor compounds while providing long term odor protection. The catalyst component interacts with the oxidant to form free radicals, while the mild oxidant provides bacteria with a preferred oxygen source, eliminating the reduction of sulfate to odorous sulfide compounds. This approach is preferable to using straight nitrate salts which are inefficient in oxidizing compounds.

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INJECTION POINTS

The most effective means of introducing the chemistry into the collection system is at the lift stations. Depending on flow rates, we can utilize wet wells or inject directly into the pump discharge. Process injection can be synchronized or flow paced with the lift station pumps to provide the most effective and economical treatment of the waste water.

TABLE 5: COLLECTION SYSTEM CASE STUDY

LOCATION	PRE-TREATMENT	POST-TREATMENT
Eastern WI Sanitary District		
Retention Time 8+ Hours 122,000 gpd		
Lift Station #5	41 ppm	0 ppm
	179 ppm	2 ppm max
Lift Station #6	127 ppm	2 ppm
	569 ppm	5 ppm max
Western WI City		
Retention Time 4 Hours 235,000 gpd	50-70 ppm peak average 297 ppm max	2 -5 ppm peak average
South Central WI Sanitary District		
Retention Time 8 Hours. Daily flow 35,000		
Lift Station	40-60 ppm peak average	0-3 ppm peak average
KY Force Main		
14.7 Miles, Retention Time: 24 Hours	15 ppm sulfide	<1.0 ppm sulfide

Case Studies

CASE STUDY

SLUDGE/BIO-SOLIDS DE-WATERING - CONTROLLING COMPLEX ODOR COMPOUNDS

Hydritreat products used:

- Oxidant: HS P, HS P3, Hydritreat CS 41
- Catalyst System: Hydritreat HS C, HS CF

ISSUE

Nearly every waste water treatment plant has a dewatering and/or solids handling process. Most commonly a belt press is used to allow water to separate from solids in sludge. This sludge typically contains a wide range of odor causing compounds, ranging from simple sulfides to complex volatile fatty acids. These odor releases are made possible by sludge agitation and the physical action of the sludge press. Employee health is a key concern in this application as the dewatering process is usually contained within a separate room. Corrosion can also be more pronounced in this process for the very same reason.

APPLICATION

The process chemistry is introduced into available flow equalization vessels or in line. A retention time of 3-5 minutes is preferred for sludge streams due to the high organic/solids content as well as high target compound concentration. Some situations call for the Hydritreat process to be started in a slip stream prior to being introduced into the sludge. This allows for maximum reaction speed once the two flows meet. Often times odors are an issue on solids waiting to be land applied/land filled. These solids may be stored for more than a day prior to being processed. In these cases we are able to modify our process to provide odor destruction as well as odor prevention. Product is simply sprayed on the pile and a few simple pieces of equipment used to provide up to 24 hours of protection. This application is especially useful for application in the summer months when pile odors are more common.

TABLE 6: SLUDGE DEWATERING CASE STUDY

CASE STUDY	PRE-TREATMENT	POST-TREATMENT
Municipality, Central NE 120 gpm belt press Atmospheric readings:	60-80 ppm	2-4 ppm
Rendering plant, 130 gpm belt press Atmospheric readings:	60-80 ppm	5 ave./30 peak
Municipality, VA, 180 gpm centrifuge sludge pile readings Atmospheric readings:	43 ppm	0 hr. 6.5 ppm 5 hr. 0.13 ppm 25 hr. 0.032 ppm
Municipality, NY, 95 gpm belt press Atmospheric readings:	35 ppm	0 ppm
Municipality, NY, 95,000 gpd Atmospheric readings:	25 ppm	0 ppm
Municipality, NY, 280,000 gpd Atmospheric readings:	15 ppm	0 ppm



SLUDGE - CELL WALL LYSING

INCREASING SOLIDS CONTENT IN DEWATERING OPERATIONS

Treatment of sludge to control sulfide is common to protect equipment from corrosion, and employees from safety hazards of sulfide exposure. A benefit of the treatment of biosolids with the Hydritreat HS process is the lysing of cell walls in the biomass. By lysing the cell walls, fluids contained within the biosolids are released, thus increasing the percent solids of the dewatered sludge produced. Hydrite Chemical Co. has seen this in a number of odor control applications in which sludge is treated with the H HS process. On average, solids are increased from 2-5%. A quick evaluation of the cost of transport and disposal of sludge may justify treatment of the sludge on this factor alone. Evidence exists (Dewells, Appels, et. Al. 2007) that biogas production can be increased by pretreating biosolids with hydroxyl radicals prior to entering anaerobic processes. It is concluded that COD can be converted to more readily available and soluble BOD, thus increasing the amount of biogas produced with anaerobic digestion. This study is further supported by our findings that depolymerization of biomass is possible using the H HS process, reducing the chain length of cellulosic materials such as those found in various forms of paper. This could allow for increased efficiencies in biological digestion of solids in WWTP.

POND/LAGOON TREATMENT

LARGE VOLUMES

Hydrite Chemical Co. has been involved in situations in which large bodies (>20 mil. Gal.) of odorous water must be treated. While we continue to use the same chemistry as in other odor control applications, the method of delivery is different. It becomes necessary to re-circulate the water in order to contact the maximum volume of the pond. This can be accomplished using on-site pumps/fluid handling systems, or Hydrite can bring in portable systems. We have developed methods of treating large bodies of water depending on the specifics of the pond/lagoon. It may be necessary to control odors without impacting biological activity so that biological water treatment can continue. Conversely, it may be more important that the odors be eliminated without concern for biological activity. Whatever the desired outcome, we will work closely with our customers to meet their needs.



GOING PUBLIC

From time to time odor situations develop to a point where the public considers them to be unbearable. It is critical to avoid any odor issues getting this far as regulatory agency involvement is seldom a pleasurable experience. Hydrite Chemical Co. has been involved on the public stage supporting our customers who have situations that have developed to nuisance levels. We have participated in city council meetings, provided detailed treatment plans, and worked closely with state regulatory agencies to provide assurance that the issue can and will be resolved. We are pleased to say that we have provided relief to our customers in all of our efforts, and have received letters of support from our customers as well as favorable press in the media. We would prefer to avoid these situations by treating problems before they become a crisis, but know that Hydrite Chemical Co. is here to help resolve these issues should they arise.



If you're looking for a comprehensive chemical partner with your profitability in mind, call 262.792.1450 and learn how we will help you simplify your chemical program, streamline logistics and reduce your operating costs.

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