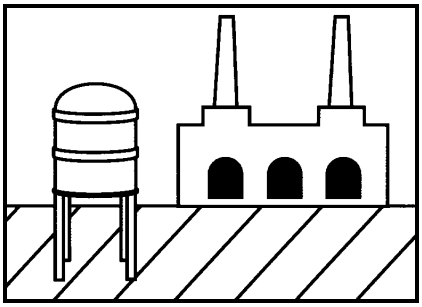
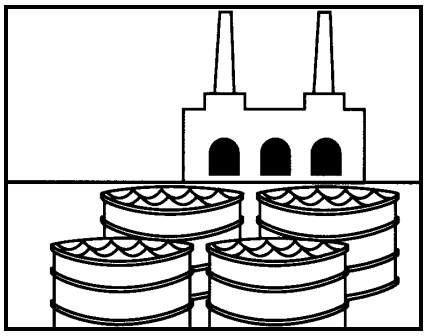
Technical Bulletin

HTH®* Dry Chlorinator for Use in: INDUSTRY: Cooling Water, Pulp & Paper, Wastewater Treatment



Advantages of HTH®*Dry Chlorinator: *HTH®* Dry Chlorinator, which contains 68% available chlorine, is calcium hypochlorite, one of the most effective sanitizers known. It is convenient, easy to use and handle, doesn't require expensive, complex metering equipment or large storage tanks, and doesn't lose strength rapidly during storage. Be sure to comply with all government regulations for use.*



CONTENTS

CYANIDE WASTE TREATMENT

In most cases, cyanide will be contained in liquid waste. When cyanide is found in solid waste, it must be dissolved in water to 500 ppm or less to prevent a high reaction temperature.

Approximately 4.2 kilograms of HTH® Dry Chlorinator per kilogram of free cyanide in the waste will oxidize the toxic cyanides, producing harmless cyanates. This reaction is slowed by the presence of monovalent nickel and copper in the waste liquid, so it's important to analyze the contents of the waste thoroughly before the HTH chlorine solution is prepared. Table 1 shows how much HTH Dry Chlorinator will be needed, depending on the content of the waste.

Batch Treatment

Where cyanide concentrations in waste are relatively high and the flow is within practical limitations (less than 50 cubic meters in an 8-hour period), batch treatment provides an effective, economical method of chlorination. The

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HTHADS00-5
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following is a general description of a typical batch treatment with HTH Dry Chlorinator.

Divert all waste water containing cyanides to a steel or concrete retention tank, located in a well-ventilated or open air area. Avoid mixing cyanide waste with acid waste, plant sewage and other plant waste.

The proper capacity of the retention tank is determined by the frequency of batches to be treated and the maximum volume of discharge during each collecting period. The tank should be equipped with an efficient agitator and a means of measuring the temperature.

Table 1

Effect of Metal Content in Cyanide Waste on Amount of HTH® Dry Chlorinator Requirement

If present in waste		*HTH* ® Dry Chlorinator per kilogram of cyanide (kilograms)
Copper	Nickel	
		4.2
*	*	4.7 to 5.5
	*	4.7 to 5.7
*		4.4 to 4.7

Once waste is collected in the tank, agitate thoroughly to establish good uniformity.

If cyanide concentrations exceed 500 ppm, waste liquid should be diluted before treatment to prevent unusually high reaction temperatures. (Waste from plating and treating baths may sometimes contain more than 500 ppm of cyanide, whereas dragout water and wash water usually will not.)

If necessary, adjust the pH of the mixture to between 10 and 11 by adding caustic soda, with constant agitation. Be sure to maintain this level during the entire process, adding more caustic soda during treatment, when necessary. ***If the pH is allowed to fall below 7.0, highly toxic hydrogen cyanide gas may be generated.***

Add 4.2 kilograms of HTH Dry Chlorinator per kilogram of cyanide evenly over the surface of the waste liquid, while agitating. Make sure the final temperature of the solution is not above 50°C or 120°F.

After agitating for at least 15 minutes, test for the presence of available chlorine. Use starch-iodide papers, a chlorine test kit or an analytical test procedure. If the presence of available chlorine is indicated, as is expected, hold the treated solution for a minimum of 1 hour without further agitation. If a minimum chlorine residual of 1.5 to 1.0 ppm is indicated, the waste may be considered free of cyanides.

In most cases, the required chlorine residual will be indicated in both the 15-minute and the 1-hour test. If either test indicates the absence of chlorine, it is necessary to add more HTH Dry Chlorinator to produce the required chlorine residual. After a 5-minute agitation period, continue with the holding and testing steps described above. The objective is to insure the presence of excess available chlorine throughout the entire treating period, with an excess clearly indicated upon completion.

Continuous Treatment

When the batch method is not practical or when continuous treatment is desirable, a uniform concentration of cyanide waste may be treated and monitored along its route from the retention basin or tank to the plant sewers.

Automatic process controls for the feeding of alkali and

HTH® DRY CHLORINATOR REQUIRED TO TREAT LOW CONCENTRATIONS OF CYANIDE IN AQUEOUS SOLUTION

Measured Cyanide Parts per Million	Required Available Chlorine, Parts per Million	Volume of Water in Cubic Meters (1 Cubic Meter = 1000 Liters)								
		1	5	10	20	30	40	50	100	500
		Kilograms of *HTH*® Dry Chlorinator Required								
50	210	0.32	1.62	3.23	6.46	9.69	12.9	16.2	32.3	162
100	420	0.65	3.23	6.46	12.9	19.4	25.8	32.3	64.6	323
150	630	0.97	4.85	9.69	19.4	29.1	38.8	48.5	96.9	485
200	840	1.29	6.46	12.9	25.8	38.8	51.7	64.6	129	646
250	1050	1.62	8.08	16.2	32.3	48.5	64.6	80.8	162	808
300	1260	1.94	9.69	19.4	38.8	58.2	77.5	96.9	194	969
350	1470	2.26	11.3	22.6	45.2	67.8	90.5	113	226	1131
400	1680	2.58	12.9	25.8	51.7	77.5	103	129	258	1292
450	1890	2.91	14.5	29.1	58.2	87.2	116	145	291	1454
500	2100	3.23	16.2	32.3	64.6	96.9	129	162	323	1615
550	2310	3.55	17.8	35.5	71.1	107	142	178	355	1777
600	2520	3.88	19.4	38.8	77.5	116	155	194	388	1939

HTH® chlorine solutions should be provided along with effluent line, allowing sufficient time lapse and agitation for complete reaction along the route of flow. Where necessary, provisions should be made for diluting highly concentrated waste. By providing additional laboratory control, this method can be operated as an effective, continuous process.

INDUSTRIAL WATER TREATMENT

Power Plants Cooling Towers

Slime, which often grows in condensers and on cooling surfaces of recirculating systems, reduces efficiency significantly.

Fifteen grams of HTH Dry Chlorinator for every 10,000 liters (or 1 ounce per 5000 gallons) of water in the system will control slime and help maximize cooling efficiency.

In systems where an accessible open section exists, HTH Dry Chlorinator may be applied directly to the cooling water. Select a point where enough turbulence exists for HTH Dry Chlorinator to dissolve quickly and completely.

When direct application is not possible, HTH chlorine solutions should be introduced into cooling water by a gravity feed or by mechanical means. Select an application point that will insure thorough diffusion of the HTH chlorine solution in water traveling to the condenser and coolers.

After circulating long enough to ensure that the HTH chlorine solution has reached all parts of the system, test the water for available chlorine. If a residual of 1 ppm is present throughout the system, the water has been sufficiently chlorinated. Test water for chlorine residual periodically and add HTH Dry Chlorinator as often as necessary to maintain 1 ppm in all parts of the system.

Cooling Ponds and Reservoirs

Slime originating in ponds and reservoirs that supply cooling systems and boilers can often cause problems inside the plant.

Fifteen grams of HTH Dry Chlorinator granular for every 10,000 liters (or one ounce per 5,000 gallons) of pond water will effectively control slime, to help prevent its further growth and interference with operations inside the plant.

Ponds and reservoirs which are fed by surface streams may be continuously treated with solutions of HTH Dry Chlorinator. Either mechanical or gravity feeders should be set up at the pond or reservoir inlet to introduce the HTH chlorine solution.

Once the solution has been distributed evenly throughout the entire body of water, test for available chlorine. A chlorine residual of 1 ppm in all parts of the water will be sufficient to control the growth of slime. Maintain this residual at all times by applying more HTH Dry Chlorinator whenever necessary.

Ice Plants

The growth of slime often occurs in ice plant condensing systems, causing increased pressure, lowering efficiency and adding to power costs.

Fifteen grams of HTH Dry Chlorinator for every 10,000 liters (or one ounce to 5,000 gallons) of water in the cooling system will effectively control the growth of slime.

In recirculating systems with an accessible open section HTH Dry Chlorinator may be applied directly to cooling water.

In closed systems, HTH Dry Chlorinator solutions should be fed by a pump or gravity feed located near the intake side of the recirculating pump.

In both cases, be sure that HTH Dry Chlorinator is evenly distributed throughout the entire system, then check for available chlorine. If a residual of 1 ppm is present in all parts of the system, the water has been properly chlorinated. Test for chlorine residual periodically and add HTH Dry Chlorinator as often as necessary to maintain 1 ppm throughout the system.

Air Conditioning

Slime often develops on the water sides of cooling surfaces in commercial air conditioning systems, greatly reducing cooling efficiency and sometimes causing flow restrictions and unpleasant odors.

HTH Dry Chlorinator, which can be added in solution or dry, will control the growth of slime in air conditioning water. A daily dosage should provide a chlorine residual of 1 ppm in all parts of the system for a 4-hour period. Under some conditions it may be necessary to temporarily increase the chlorine residual or contact time.

In recirculating systems where an open section is accessible, HTH Dry Chlorinator should be fed into the flow as rapidly as the water will dissolve it. In closed systems, HTH Dry Chlorinator solutions should be applied by a gravity feed or a hypochlorinator.

SEWAGE & WASTEWATER EFFLUENT

Effluent Disinfection

HTH Dry Chlorinator can destroy disease-producing organisms in raw or treated sewage. Therefore, it is often used as a standby treatment in large sewage systems and as a primary treatment in smaller ones.

Chlorination for disinfection must take place before the sewage reaches a septic state. (Sewage becomes septic when its oxygen is lost through decomposition and its sulfates are reduced to hydrogen sulfide.) Since chlorina-

tion usually takes 15-30 minutes, a suitable detention basin must be provided.

If hypochlorinators are being used, they should always be located near the influent of the detention basin. If mechanical stirring or other agitators are not being used, chlorination for disinfection should take place before any primary or secondary sedimentation treatments.

The amount of HTH® Dry Chlorinator solution required will vary, depending on the concentration and condition of the final effluent. About 30% of the chlorine demand of raw sewage is attributable to settled solids, 40% to suspended and colloidal solids; 30% to dissolved solids.

Disinfection should be controlled by laboratory methods, where possible. In general, use sufficient HTH Dry Chlorinator to provide a chlorine residual of 0.6 to 1.0 ppm after 15-30 minutes of contact. Experience with different types of sewage will usually establish a relationship between residual chlorine and contact time. This relationship can then become the controlling factor for the operation, with occasional bacteriological checks being made as a safeguard.

When sewage is to be temporarily disinfected before being diluted in a body of water, the following dosages will usually provide satisfactory protection against pollution of the receiving waters:

Raw sewage requires from 10-30 ppm available chlorine.

Primary treated sewage requires 4-20 ppm available chlorine.

Primary and secondary treated sewage requires 2-5 ppm available chlorine.

Bacteriological tests should be made frequently.

Hydrogen Sulfide Generation Control

Decomposing septic sewage generates hydrogen sulfide, which not only causes an odor problem, but oxidizes into sulfuric acid and causes disintegration of the masonry in the damp area above the water line.

Decomposition can be held in check by "up sewer hypochlorination" using HTH Dry Chlorinator solution in sufficient quantity to yield 15 ppm available chlorine. HTH Dry Chlorinator solution should be introduced at points throughout the sewer trunk system so that all sewage is treated before it has reached a septic condition. Where sewage has already become septic, a stronger dosage of HTH Dry Chlorinator will be needed. This method of treatment is especially valuable in sluggish collection systems or long outfalls.

Slime Control

In sewer systems and treatment plants, uncontrolled slime can clog conduits, infest trickling filters, restrict water ways and cause ponding of the filters and sludge bulking.

For slime control in conduits, the chlorination dose must be determined by the chlorine demand of the system. Chlorination in concentrations of 2-15 ppm available chlorine, based on the system's chlorine demand, will control the growth of slime. (These concentrations are equivalent to 100-1000 ppm on the basis of dry solids in the effluent at the point of infection.)

The solution of HTH Dry Chlorinator must be applied at a point where it will mix thoroughly with the effluent. The application should be repeated as required. Once the infestation has been reduced to an acceptable level, the growth may be controlled by a continuous dose of 0.5 ppm available chlorine.

When ponding of the filters is excessive, filter nozzles often become clogged. Solution of HTH Dry Chlorinator, fed continuously into the effluent from above the filter nozzles, will clean the filters properly. In extreme cases, HTH Dry Chlorinator solutions containing 15 ppm available chlorine will be necessary.

Alternatively, the filters may be removed from service, drained to a depth 30 cm above the filter sand, and treated with 250 g of HTH Dry Chlorinator per sq. m. Wait 30 minutes, then drain to a level even with the top of the filter. Wait for 4 to 6 hours before completely draining and backwashing the filter.

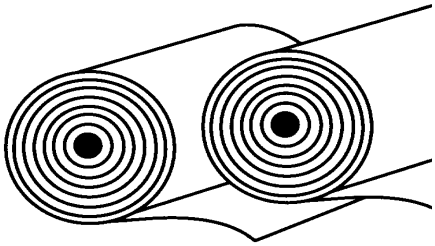
After a thorough cleaning, the filters may be kept slime-free by either of two methods: (1) a continuous dose of 0.1 ppm available chlorine; or (2) intermittent application of HTH Dry Chlorinator solution to the dosing tanks. The necessary dosage and frequency of application depend on the severity of the problem.

In activated sludge plants, slime can interfere with proper settling, causing "bulking sludge." HTH Dry Chlorinator solutions containing 2 to 8 ppm available chlorine, introduced into the return sludge line, will effectively control this problem.

B.O.D. Reduction

The discharge of sewage with a high biochemical oxygen demand (B.O.D.) into lakes and streams can cause odors, visual pollution and death to aquatic life.

This condition can usually be avoided by applying HTH Dry Chlorinator solution to the effluent until a substantial residual is obtained. Application should be made at a point which will permit a 10-20 minute contact period before the discharge of the effluent into the stream. Minimum dosage to a residual of about 0.2 ppm after a contact time of at least 10 minutes will reduce the effluent's B.O.D. 10-30%. Where longer-lasting or greater B.O.D. reductions are necessary, increased chlorine residuals are recommended.



PAPERMAKING INDUSTRY

In general, HTH® Dry Chlorinator is an effective bleaching agent for all the common paper dyes. To be sure that a particular dye is bleachable with HTH chlorine solutions, the dye must either be identified properly or tested for bleachability.

How to Identify Dyes

In all, about 100 different types of dyestuffs are used for coloring paper. But every manufacturer has its own name for each generic dye - resulting in thousands of different trade names.

A comprehensive directory, the Colour Index, is published by the American Association of Textile Chemists and Colorists (AATCC), providing a cross-reference of generic and trade names. Volume 5 lists dyes generically, each with a color index number that corresponds to every trade name for that particular dye. So if the generic type is known, all trade names can be found and vice versa.

Figure 1 lists some of the common generic paper dyes which can be bleached with HTH Dry Chlorinator. (Listings appear just as they do in the AATCC Colour Index.)

How to Test for Bleachability

When dyes in colored broke are unidentified, the following simple test will determine whether or not HTH Dry Chlorinator will be an effective bleaching agent.

Make up a small quantity of 3% HTH chlorine solution and add a few handfuls of broke. If all color is destroyed (even in mixed color batches), the entire batch should bleach out when treated with HTH Dry Chlorinator.

The Bleaching Process

Quantities of water and HTH Dry Chlorinator necessary for effective bleaching should be determined by the dry weight of the broke to be processed. As a rule, the available chlorine content of solutions should be about 2% of the dry broke weight.

Example:

One thousand kgs or 2,500 lbs. of broke will require 20 kgs (1000 x .02) or 50 pounds (2,500 x .02) of available chlorine. And since HTH Dry Chlorinator contains 65% available chlorine, 31 kgs (20 kgs divided by 65%) or 77 lbs. (50 divided by 65%) will be required to deliver the proper amount of chlorine.

To assure the proper consistency of the final pulp, the weight of the dry broke should be 5 to 6% of the total weight of the broke and water. To attain this consistency, use 20 liters of water for every kg of dry broke. Thus, to bleach 10000 kgs of dry broke, 20,000 liters of water will be needed.

Ideally, HTH Dry Chlorinator should be introduced as a solution through a perforated pipe or sparger arrangement. Otherwise, it should be added evenly with a clean, stainless steel scoop. Do not handle HTH Dry Chlorinator with bare hands.

Storable stock solutions prepared in volume should contain 4.6 kgs of HTH Dry Chlorinator for every 100 liters (or 10 lbs. per 26 gallons) of water. Make sure mixing water is warm. Store the stock solution in plastic containers.

If a solution is used, benchmark proportions for the full charge should be adjusted, as follows, to account for the water added with the HTH Dry Chlorinator:

100 kgs dry broke

1600 liters water

67 liters HTH stock solution

The actual bleaching process can be accomplished in a conventional pulping unit. To prepare the bleach run, add the proper amount of water required by the dry broke weight and heat to 60°C or 140°F. (If water is too cool, the solution will not activate properly. Under 21°C or 70°F, bleaching may not occur.)

Once the water is heated, broke should be added and pulped. HTH Dry Chlorinator, either in solution or dry, should then be introduced as quickly and evenly as possible during the beating cycle.

If colors are relatively light or weak, the proportion of HTH Dry Chlorinator to dry broke weight may be reduced. Experience will dictate the most economical quantity to use in each case. It is useful to log actual proportions by color, so that future batches of the same or similar shades can be treated routinely.

If necessary, the final step in the bleaching process is to reduce the pH of the pulped mixture to 5 or 6. At the end of the beating cycle, use 0.5% sodium acid sulfate (nitre cake) or dilute sulfuric acid. (Do not use alum, since it tends to set extraneous foreign matter on the pulp.)

Pulp bleached with HTH Dry Chlorinator is often reused without draining or washing. However, draining reduces residual matter which may discolor the pulp; and washing ensures an even brighter, cleaner product.

Because the free chlorine from HTH Dry Chlorinator is almost completely consumed in the bleaching process, no antichlors (e.g. sodium thiosulfate, sodium sulfite) need be added at any point in the procedure.

Figure 1

Common Paper Dyes Bleachable with HTH® Dry Chlorinator

Generic Name	Colour Index Number	Generic Name	Colour Index Number	Generic Name	Colour Index Number
Acid Red		*Basic Orange*		*Direct Blue*	
14	14720	2	11270	6	22610
88	15620	*Acid Yellow*		14	23850
27	16185	36	13065	8	24140
18	16255	3	47005	1	24410
1	18050	2	47010	*Basic Blue*	
73	27290			26	44045
Direct Red		*Direct Yellow*		9	52015
20	15075	4	24890	*Acid Violet*	
28	22120	*Basic Yellow*		17	42650
17	22150	2	41000	*Basic Violet*	
37	22240	*Acid Green*		1	42535
1	22310	3	42085	23	42555
2	23500	9	42100	5	50205
75	25380			*Direct Brown*	
81	28160	*Direct Green*		2	22311
23	29160	6	30295	1	30045
Basic Red				6	30140
1	45160	*Basic Green*		*Basic Brown*	
2	50240	4	42000	1	21000
Acid Orange		1	42040	*Acid Black*	
7	15510			1	20470
8	15575	*Acid Blue*		2	50420
Direct Orange		22	42755	*Direct Black*	
8	22130	45	63010	38	30235

Pulp & Paper Mill Process Water

SLUG FEED METHOD

Initial Dose: When system is noticeably fouled, apply 7.5 to 15 grams of HTH Dry Chlorinator for each cubic meter of water in the system to obtain from 5 to 10 ppm available chlorine. Repeat until control is achieved.

Subsequent Dose: When microbial control is evident, add 1.5 grams/m^3 of water in the system daily, or as needed to maintain control and keep the chlorine residual at 1 ppm. Badly fouled systems must be cleaned before treatment is begun.

INTERMITTENT FEED METHOD

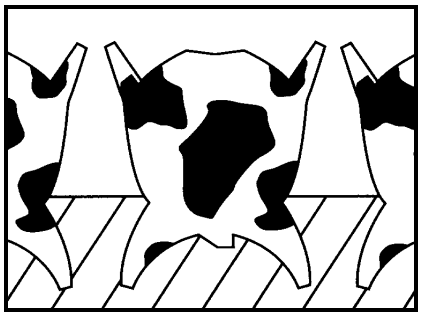
Initial Dose: when system is noticeably fouled, apply 7.5 to 15 grams of HTH® for each cubic meter of water in the system to obtain 5 to 10 ppm available chlorine. Apply half (or 1/ 3, 1/4, or 1/5) of this initial dose when half (or 1/3, 1/4, or 1/5) of the water in the system has been lost by blow down.

Subsequent Dose: When microbial control is evident, add 1.5 grams/m^3 of water in the system to obtain a 1 ppm residual. Apply half (or 1/3, 1/4, or 1/5) of this initial dose when half (or 1/3, 1/4, or 1/5) of the water in the system has been lost by blow down. Badly fouled systems must be cleaned before treatment is begun.

CONTINUOUS FEED METHOD

Initial dose: When system is noticeably fouled, apply 7.5 to 15 grams of HTH for each cubic meter of water in the system to obtain 5 to 10 ppm available chlorine.

Subsequent Dose: Maintain this treatment level by starting a continuous feed of 1.5 grams/m^3 of water lost by blowdown to maintain a 1 ppm residual. Badly fouled systems must be cleaned before treatment is begun.



TANNERIES

HTH ®Dry Chlorinator as a bleaching agent, is quite effective in removing coloring matter from wooden drums used in the dyeing of leather. An HTH chlorine solution containing 1-3% available chlorine is recommended.

First, clean the drum in the usual manner. Then, for each 100 liters of drum capacity, add 10 liters of water at 65°-85°C (150°-180°F.)

Use Table 2 or 3 to determine how much HTH Dry Chlorinator is required. Then use 10 liters of warm water to dissolve each kilogram or pound of HTH Dry Chlorinator.

Add this warm bleach solution to the dye drum and agitate for 25 to 30 minutes longer. Be sure the solution makes complete contact with all the drum parts to remove color thoroughly.

Tannery Waste Liquors

HTH chlorine solutions will control bacterial activity and odors in tanning waste liquors.

All effluents which result from the soaking and treating of skins (up to the liming process) should be discharged into a retention basin and held for at least 2 hours.

The HTH chlorine solution may be fed directly into the effluent flow before it enters the retention basin or it may be introduced into the basin itself. A gravity feed tank which feeds a 3% available chlorine stock solution is recommended. Once the HTH chlorine solution has reached a residual of 250 ppm, waste liquid should be agitated.

Table 2

Required Amounts of *HTH* ®Dry Chlorinator

(Kilograms)

Available Chlorine	Liters					
(%)	5	10	20	50	100	200
1.0	0.08	0.15	0.30	0.75	1.50	3.00
2.0	0.15	0.30	0.60	1.50	3.00	6.00
3.0	0.23	0.45	0.90	2.25	4.50	9.00
5.0	0.38	0.75	1.50	3.75	7.50	15.00

Table 3

Required Amounts of *HTH®* Dry Chlorinator

(Pounds-Ounces)

Available Chlorine	Water (Gallons)			
(%)	1	5	10	50
1.0	0-2	0-11	1-5	6-8
2.0	0-4	1-5	2-10	13-0
3.0	0-7	1-15	3-15	19-9

RELATED INFORMATION

HTH® Dry Chlorinator Product Data AD6158-297

HTH® Dry Chlorinator for Use in: Cleaning and Sanitizing HTHADS00-6

HTH® Dry Chlorinator for Use in: Municipal Water and Wastewater HTHADS00-7

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