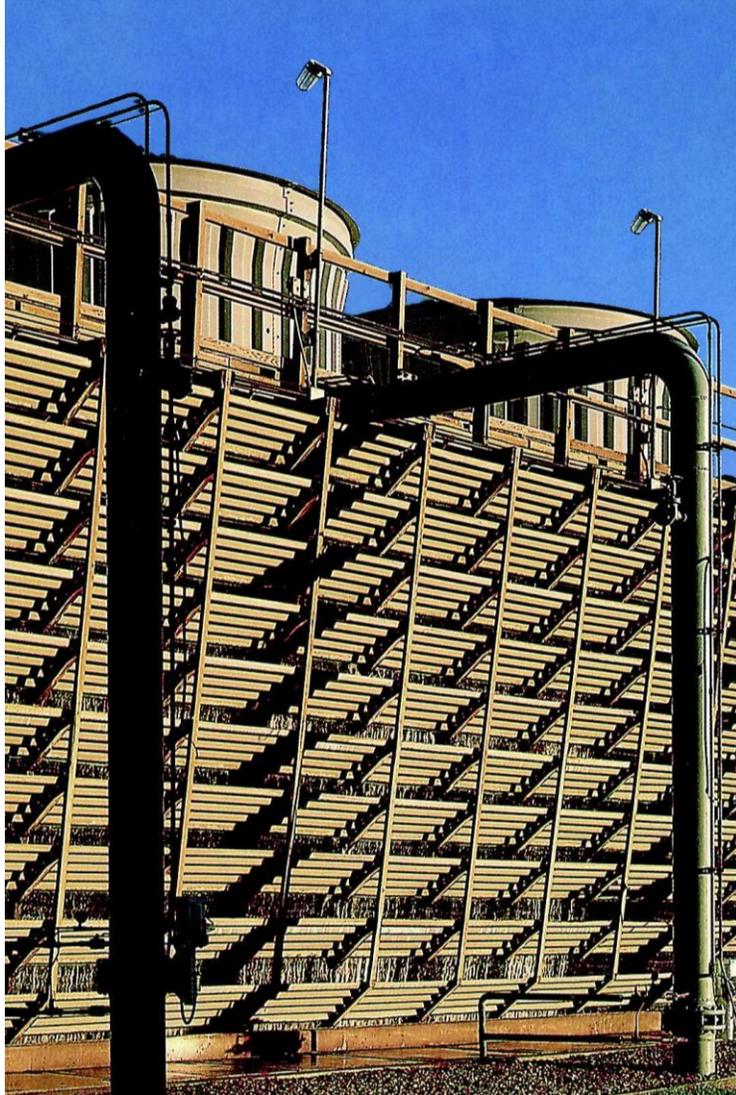


OxyChem[®]



T Towerchlor[®]

**MICROBICIDES FOR
COOLING WATER SYSTEMS**

Towerchlor[®] Microbicides

Towerchlor[®] 56 Granules and Towerchlor 90 Tablets are excellent sources of free available chlorine for the control of biofouling in cooling waters. The dry form of these products and ease of handling eliminate the need for expensive and cumbersome equipment normally required for either chlorine gas or liquid bleach. Towerchlor microbicides eliminate the hazards and reporting requirements of chlorine gas and are applied through simpler systems than liquid bleach. These products provide a safe and effective method of cooling water chlorination.

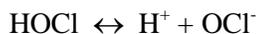
Bactericidal Action of Chlorine

The Towerchlor products, like chlorine gas or liquid bleach, exert their bactericidal action in solution by forming hypochlorous acid (HOCl) when dissolved in water.



All of the chlorine in the Towerchlor products is available as free chlorine, so this chlorine is as effective as gaseous chlorine.

In alkaline solutions, hypochlorous acid ionizes to the hypochlorite ion:



Hypochlorous acid is considerably more effective as a microbicide than the hypochlorite ion. Therefore, greater bacterial control occurs in acidic solutions than in alkaline solutions at the same chlorine levels. The Towerchlor products are thus excellent microbicides for neutral or slightly alkaline water treatment programs. For systems with pH 7.5 and above, bromine chemistry can provide a more economical choice than chlorine chemistry. OxyChem's Towerbrom[®] bulletin describes the recommended products for systems with higher pHs.

The primary reason for chlorinating cooling tower water is to prevent biofouling of the heat exchanger. Microorganisms do not build up a resistance to free chlorine over time. However, each microorganism has a specific sensitivity to free chlorine, which governs the concentration of free chlorine and the contact time required to kill that microorganism.

The easiest microorganisms to control are those which float free in the cooling water. The same microorganisms become less sensitive and require a higher dose of free chlorine once they are attached to a surface as part of a biofilm. A visible algae colony is even more resistant to free chlorine, once established. Therefore, any microbicide should be added frequently enough to prevent the establishment of a biofilm or an algae colony.

Towerchlor's Advantage in Sunlight

The ultraviolet (UV) light in sunlight causes rapid decomposition of active halogens. Systems with strong

sunlight exposure, such as cooling ponds, decorative fountains, or lagoons can lose up to 90% of their active chlorine or bromine in 3-4 hours. The cyanuric acid in these products stabilizes active chlorine against decomposition by UV light. The active chlorine from the Towerchlor products will last up to four times longer in these systems than unstabilized chlorine from gas or bleach. Active bromine cannot be stabilized in the same manner, so the Towerchlor products are the clear choice in these systems.

Choice of Towerchlor Product

OxyChem markets two Towerchlor products, Towerchlor 56 Granules and Towerchlor 90 Tablets (see Table 1).

Quick dissolving Towerchlor 56 Granules are ideal for shock feeding. Dispensed by hand, Towerchlor 56 Granules dissolve almost immediately for quick release of the active halogen. Solutions are nearly pH neutral, so Towerchlor 56 Granules have virtually no effect on the cooling water pH.

Towerchlor 56 Granules are classified as an NFPA Class 1 oxidizer, which is less hazardous than Class 2 or 3 oxidizers. There is no need for a DOT oxidizer label, and the storage requirements are less stringent.

Towerchlor 90 Tablets are sold as solid, easy-to-use three inch or one inch diameter tablets. Towerchlor 90 Tablets work well in either continuous or shock treatments. Towerchlor 90 Tablets dissolve slowly for sustained release. However, they dissolve more rapidly than the chlorinated or bromo-chloro- hydantoin and can respond faster to changes in demand.



Both Towerchlor products are completely soluble and do not contain any metal ions, like calcium, which can contribute to the scaling potential of the cooling water.

Methods of Use

Current biofouling control techniques include both periodic shock treatments with microbicides and low level continuous application of microbicides. The Towerchlor products can be easily applied to either method of treatment.

For continuous chlorination,

The surface area of a Towerchlor 90 three inch tablet changes very little as it dissolves. This means that over time, a feeder with Towerchlor 90 Tablets will provide a consistent output for a given flow setting. Towerchlor 90 Tablets also have the highest available chlorine content (90%) of any solid or liquid oxidizing microbicide. This means that you can use smaller, less expensive feeders and refill them less often. These tablets are also suitable for other types of dispensers, such as buckets or bags.

We have tested many different feeders with excellent results. Contact us for feed rate data and recommendations. OxyChem also offers two inexpensive tablet feeders which are ideal for small water systems. See our feeder brochure for more information.

For shock feeding,

If a shock feed program is desired, first consider using Towerchlor 56 Granules. Their fast dissolution rate allows the full dose to be attained in a matter of minutes. Broadcast Towerchlor 56 Granules by hand since this product dissolves too quickly for use in feeders.

If Towerchlor 90 Tablets are used for shock feeding, certain steps must be taken to ensure safety. Wet tablets under stagnant conditions will slowly generate nitrogen trichloride (NCl_3), which can be hazardous if formed in sufficient quantities. Therefore, Towerchlor 90 Tablets should not sit in stagnant water after the feeder shuts off. A feeder must be purged to remove NCl_3 as it is formed. Modify a feeder used for shocking to either: 1) drain out the water when the feeder shuts off, or 2) maintain a minimal water flow between shocks.

Packaging

Towerchlor microbicides are packaged in convenient, resealable 50 lb. all-plastic pails with screw-on lids. There are 24 pails (1200 lb.) to a pallet.

These products have excellent storage stability. Unlike liquid bleach, they maintain their chlorine content indefinitely.

Registrations

Towerchlor microbicides are classified as pesticides and require registration with the U. S. Environmental Protection Agency and with each state where they will be sold. The costs of these EPA and state registrations continue to rise. OxyChem helps you control these costs in either of two

ways. You can buy the Towerchlor products with OxyChem labels and avoid paying any registration costs. Alternatively, OxyChem offers supplemental registrations and will apply your approved label to the package before shipment. You avoid the cost of relabeling and pay only the state registration fees where you sell the Towerchlor products.

Precautions

These products are strong oxidizing agents which require proper handling and storage. Improper handling may cause a reaction leading to fire or explosion. Consult the Safety Data Sheet (SDS) for details. In particular:

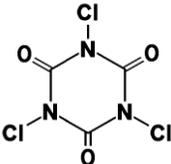
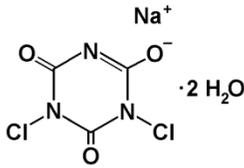
- Never block-in a feeder containing Towerchlor 90 Tablets.
- Never add any other chemical to a feeder containing Towerchlor 90 Tablets.
- Never add Towerchlor 56 Granules to a tablet feeder, always add directly to the water system.
- Read the label and SDS carefully before using.

Key Advantages

- ▶ **Highest halogen content (Towerchlor 90 Tablets) of all solid oxidizers**
- ▶ **Fastest dissolving (Towerchlor 56 Granules) of all solid oxidizers**
- ▶ **Simpler, smaller feeders**
- ▶ **Easy and safe to store and handle**
- ▶ **Stabilized against UV degradation**
- ▶ **No calcium**
- ▶ **Cost effective**
- ▶ **Supplemental registrations available**
- ▶ **Registered in the U.S., various states and Canada**

For more information contact OxyChem Technical Service: (800) 733-1165, Option 4.



TABLE 1: Physical and Chemical Properties of the Towerchlor® Products		
	Towerchlor 90 Tablets	Towerchlor 56 Granules
Chemical Nomenclature	Trichloro-s-triazinetriene	Sodium dichloro-s-triazinetriene dihydrate
Chemical Structure		
Formula	Cl₃(NCO)₃	NaCl₂(NCO)₃•2H₂O
Molecular Weight	232	256
Color & Physical Form	white 3-inch diameter 227 gram (8 oz.) tablets	white free-flowing granules
% Available Chlorine	90	56
Bulk Density, lb./cu. ft.	62	59
Melting Point, °C (with decomposition)	225-230	Loses 1 H₂O at ~50, 2 H₂O at ~95 Decomposes at 240-250
Solubility at 25°C, gm/100 gm H₂O	1.2	25
pH, 1% Solution at 25°C	3.0	6.0
Dissolution Rate (in 100 ml stirred water at 25°C)	Contact OxyChem for details	1 gm dissolves in 1 min 10 gm dissolves in 3 min

Highly Effective, Cost-Competitive Microbicides

- ▶ Designed and labeled specifically for industrial and commercial water recirculation systems.
- ▶ Controls microorganisms via shock feed and continuous feed methods.
- ▶ Available in durable and non-dusting tablets to provide a more uniform dissolving rate (Towerchlor® 90 Tablets). Also available in granular form for shock treatment (Towerchlor® 56 Granules).
- ▶ Tablets can be used with conventional feeder equipment without major cost and/or equipment modifications.



Towerbrom[®]/Towerchlor[®] Microbicides

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