DMH: the non biocidal bleach stabeliser that brings 80% of the Chlorine-dioxide benefits at only 20% of the investment costs.

Di-Methyl-Hydantoine (DMH)- Stabilizer
Improving The Effectiveness Of Cooling Water Halogen Programs

Maximizing cooling tower cycles of concentration offers many benefits that help reduce water consumption and minimize waste generation for large industrial users and power generators. However, increased cycles can also shape a perfect environment for microorganisms to thrive, which can greatly reduce system efficiencies and create health and safety concerns.

Many cooling tower operators use sodium hypochlorite (NaOCl / Industrial Grade Bleach) to control and prevent the growth of microorganisms in their systems. But due to the nature of this halogen product, a circular battle often exists between too little NaOCl treatment, resulting in biofilm formation, or too much NaOCl treatment, which can greatly accelerate corrosion within the system, generate unwanted DBP (disinfection by products) and destroy expensive treatment chemicals like azoles , phosphonates and scale inhibiting polymers.
Liévin De Vriese from IMCHLO, a company specialized in improving chlorine use for biocontrol in industrial water systems, discusses key issues concerning biofilm control and how the use of DMH stabilizer, a non-biocidal halogen approach, can improve the effectiveness of cooling water halogen programs and bring stability and consistency to the process.

Please give us an overview of halogen water treatment in cooling towers.

In cooling towers serving large industries and power plants, operators are disinfecting large volumes of water. These systems reuse water, but we're still talking about massive volumes. Companies treating volumes this high typically lean toward using a relatively inexpensive disinfectant like industrial grade bleach to provide microbial control. It can be effective, but also has its drawbacks.
Bleach, when injected into water, produces hypochlorous acid, which is the key molecule that does the actual disinfecting. This molecule is very reactive to most everything in the water, like dirt and silt, leaves, and other material. Because of this, much of the hypochlorous acid is consumed before it even has a chance to do what you actually want it to do – control biofilm. That's why adding the halogen stabilizer DMH should be an important component in cooling water halogen programs, especially in large systems.

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Why is controlling biofilm so important?

In cooling tower water, there are typically planktonic bacteria, which basically float around in the water, and also sessile bacteria, commonly referred to as biofilm. Biofilm grows and attaches to surfaces within the cooling system. When biofilm attaches to vital heat transfer surfaces inside the cooling tower, it impedes the heat transfer process. This decreases the efficiency of the system and, if left unchecked, can lead to system fouling. Another serious problem related to biofilm is Legionella. Legionella grows and harbors in biofilm, presenting a considerable public health and safety concern.

Can't the halogen dosing rate simply be increased to effectively control biofilm?

When you do that you not only increase your bleach costs, you're also feeding more chlorides into your system, which accelerates corrosion. Besides producing hypochlorous acid, sodium hypochlorite in water also produces chlorides. Most cooling towers have components with stainless steel surfaces. For the most common alloys (304 & 316) the tolerance is less than 1 ppm for temperatures above about 80C. At 50C they can withstand about 100 ppm of chlorides.
If you feed too much bleach into a system that's running at multiple cycles of concentration, you run the risk of the chloride level rising to the point where it can quickly corrode vital parts of the system.
Another unwanted side effect from increased bleach dosage is the formation of undesirable Disinfection by products like AOX. The formation of these environmental unwanted products significantly increase with increased bleach dosage.
Last but not least an increased uncontrolled bleach dosage also destroys/ oxidizes a significant part of the dosed expensive water treatment products. Active components like azoles (a Cu inhibitor), phosphonates (threshold scale-corrosion corrosion) and poly acrylates 'scale inhibition) are just like the other organics attacked by the bleach.

How does DMH stabilizer work, and what are its benefits to cooling tower operations?

The DMH approach stabilizes the hypochlorous acid molecule in bleach. It makes it less reactive with everything that's in the water. It stabilizes the molecule so that it can better do what you need it to do – prevent and destroy biofilm. The stabilizer controls the release of active halogen to significantly improve biofilm penetration.

The economic benefits to using DMH stabilizer make it close to a cost neutral program, or better. Validation of the cost/benefit balance shows in most cases a positive business case. Cost reductions are generated , amongst other, in the domain of sodium hypochlorite use and corrosion rates due to a reduction in HOCl formation or a reduction in NaOCl feeding rates.. This greatly reduces replacement costs. There's also preventive maintenance costs eliminated because biofilm is removed without shutting down and draining your cooling tower to scrub and clean surfaces.. The heat-transfer inefficiencies (Energy Water Nexus) due to biofilm result in higher costs to the cooling water process. With DMH stabilizer as part of a halogen program serving a well-maintained heat exchanger, the removal of biofilm can go a long way in reducing energy consumption and CO_2 emissions.

How do you treat cooling tower water using DMH Stabilizer?

Prior to applying the program an extensive Mechanical/ Operational and Chemical pré-evaluation of the system is done. This MOC-audit reveals if the DMH approach can be considered to help reach the desired status and what would be the forecasted treatment investment. If a positive pré-evaluation is achieved (which is the case for 50-75% of the systems using bleach) a validation protocol is generated. This protocol describes the current conditions of the system, the desired status and how to measure. When possible the difference between current/desired status is financially quantified. If figures are lacking a "agreed best assumption " approach is applied.

During validation/treatment DMH product is fed in conjunction with bleach. It's a very simple feed system with two tanks – one with sodium hypochlorite and one with DMH stabilizer. Both product are fed into a static mixer and then the mixture is injected into the cooling tower. Adjusting the bleach/stabilizer ratio to meet a target 1.5 to 2.0 ppm total halogen and 0.2 to 0.5 ppm free halogen residual can optimize the performance of this program. A clean cooling tower system with low halogen demand, for example, may require a minimum ratio of 5:1 bleach to stabilizer, whereas a cooling system with high halogen demand might require closer to a 2:1 ratio.
Adding the DMH halogen stabilizer to a system in conjunction with a bleach treatment is an important step toward maintaining an effective cooling water halogen program. It is proven treatment to consider, especially if one is thinking about switching from bleach to chlorine dioxide.

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