

Halogen Resistant Azole

What are Azoles?

Azoles are ringed organic molecules that are used as corrosion inhibitors for copper and copper alloys in cooling water treatment programs. Azoles were originally developed as paint additives in the 1950's; however, in the 1970's, they were discovered to be effective copper corrosion inhibitors in aqueous systems.

How Do They Work?

Azoles bond with copper ions at the metal surface to form a protective layer that inhibits the oxidation reaction of the corrosion cell. Azoles also react with copper ions in the bulk water phase to reduce soluble copper in the water.

What is the Significance of Soluble Copper in the Bulk Water?

There are two primary concerns. First, from an environmental standpoint, soluble copper is toxic and needs to be properly controlled in any discharge stream. Second, soluble copper will plate out on mild steel surfaces and form galvanic corrosion sites that result in severe localized corrosion and premature failure of steel heat exchangers.

What Types of Azoles are Currently Being Used?

The most common azole in the water treatment market is Tolytriazole (TTA). TTA is typically fed continuously to maintain a protective layer that will minimize copper alloy corrosion. Two other azoles are Benzotriazole (BZT) and Copper-Trol (CU-1).

BZT is similar to TTA in application technology but does not form as durable a film. Copper-Trol forms the strongest protective layer of any azole but because of high costs, is limited to slug feed applications where large volume systems need to be passivated quickly.

Is it True That Halogen-Based Oxidizing Biocides Used in Cooling Treatment Programs React With Azoles?

Yes! Both chlorine and bromine, as well as chlorine dioxide, will degrade the azole molecule and prevent its beneficial reaction with copper ions. This can lead to excessive azole feed in order to maintain a residual in the cooling water sufficient to protect the copper surface. The halogen-azole reaction also leads to an increase in demand on the halogen program and results in higher biocide feedrates. In addition, when azoles are degraded and corrosion rates are compromised, copper ions will lead to galvanic pitting corrosion on mild steel surfaces which will reduce equipment life. Finally, both chlorine and bromine attack the protective films formed by azoles, causing them to break down, resulting in a loss of corrosion protection.

Is There Any Alternative Copper Corrosion Technology that is Stable in the Presence of Halogens?

Yes! A new, patented azole molecule has been developed which is stable in the presence of halogens. The technology is referred to as HRA, Halogen Resistant Azole. The protective film formed by HRA on copper surfaces is far superior and more resistant to halogens than that formed by TTA. In fact, this material is a better corrosion inhibitor than TTA even in the absence of halogen-based oxidizing biocides.

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I'm Getting 0.15 mils Per Year Now on My Copper Equipment With TTA, Why Do I Need HRA Technology?

The primary concern is not necessarily corrosion rate but copper release and its effect on the environment and on mild steel equipment. For example, a reduction of .02 mils per year for a system with 500,000 ft² (46,452 m²) of copper surface, may seem insignificant and barely worth recording. However, this improvement in corrosion rate would lead to a 13% reduction in copper release throughout the year and this becomes significant in terms of the environment and equipment life.

Does HRA Also React With Copper in the Bulk Water to Prevent Mild Steel Pitting?

Yes, The same reaction that takes place with the other azoles also takes place with HRA. In fact, when compared to TTA and BZT, the HRA molecule has the highest potential to react with copper ions. This helps to further reduce the likelihood that copper corrosion products will lead to galvanic corrosion and pitting. Unlike TTA and BZT, HRA will form a complex even in the presence of high levels of halogen.

I Notice An Odor When I Feed TTA to a Cooling System That Uses Chlorine, Does HRA And Chlorine Have the Same Odor?

No. The caramel-like odor that is associated with the reaction of TTA and chlorine, does not occur when using HRA. BZT can also be used to eliminate the odor, however, BZT does not form a strong inhibitor film and is not stable in the presence of halogens.

Where can I get HRA?

HRA is patented and exclusive to GE Water & Process Technologies. It is formulated into GE's Dianodic* PLUS Technology for open recirculation treatment programs. Dianodic III encompasses the halogen stable neutral pH programs and Continuum* AEC covers the halogen stable alkaline pH programs. Contact your GE Water & Process Technologies sales representative for more information on the HRA molecule and GE's Dianodic PLUS Technology.

Is There Any Other Copper Inhibitor Like HRA?

No. HRA is the only halogen resistant azole in the world.