Chloramine-Induced Corrosion in Copper Plumbing Systems

A technical paper by Olympian Water Testing specialists

The chemical properties and reactions of chloramines in plumbing systems

Chloramines are a commonly used disinfectant in water treatment systems, but they can also cause corrosion in copper plumbing systems. In this paper, we will explore the specific chemical reactions that occur when chloramines come into contact with copper plumbing and how these reactions lead to corrosion.

Chloramines are a combination of chlorine and ammonia, and are available in two forms: monochloramine and dichloramine. Monochloramine is the most commonly used form of chloramines in water treatment, and is created by adding ammonia to chlorine [1]. Dichloramine is less commonly used and is created by adding more chlorine to water that has already been treated with monochloramine [2].

When chloramines come into contact with copper plumbing, several chemical reactions take place that can lead to corrosion. The first reaction is the formation of copper chloramine compounds, such as copper(I) chloramine and copper(II) chloramine [3]. These compounds can adhere to the surface of the copper pipes and can lead to the formation of a corrosion film.

The second reaction is the oxidation of copper by the chloramines. Chloramines can act as an oxidizing agent, which can lead to the formation of copper oxide and copper hydroxide on the surface of the pipes [4]. These compounds can also lead to the formation of a corrosion film.

The third reaction is the dissolution of copper by the chloramines. Chloramines can react with the copper to form copper chloride, which can dissolve in the water and contribute to the corrosion of the pipes [5].

The fourth reaction is the formation of complex compounds with other dissolved elements present in the water and also the formation of complex compounds with other dissolved elements present in the water which can lead to the formation of a corrosion film.

The corrosion caused by chloramines in copper plumbing systems can lead to several problems. It can cause the formation of pinhole leaks, which can lead to water damage and potential health hazards [6].Additionally, the corrosion can also lead to the reduction of the overall diameter and cross-sectional area of the pipes, which can result in reduced water flow and increased pressure drop in the system [7]. Furthermore, corrosion can also lead to the release of copper into the water, which can be harmful to human health if consumed in high levels [8].

It is important for water treatment facilities to be aware of the potential for chloramines to cause corrosion in copper plumbing systems and to take steps to mitigate this

problem. One way to do this is by reducing the levels of chloramines in the water, or by switching to alternative disinfectants that are less likely to cause corrosion [9]. Additionally, regular monitoring and maintenance of copper plumbing systems can also help to identify and address any corrosion issues before they become severe [10].

In conclusion, chloramines are a commonly used disinfectant in water treatment systems, but they can also cause corrosion in copper plumbing systems. The corrosion is caused by several chemical reactions including the formation of copper chloramine compounds, oxidation of copper, dissolution of copper, and formation of complex compounds with other dissolved elements present in the water. The corrosion can lead to several problems such as pinhole leaks, reduced water flow, and release of copper into the water. Water treatment facilities should be aware of the potential for chloramines to cause corrosion and take steps to mitigate it.

[1] “Chloramines: A Guide for Drinking Water Systems.” US Environmental Protection Agency,
[2] “Chloramines: An Alternative Water Disinfectant.” American Water Works Association,
[3] “Chloramines and Copper Corrosion in Drinking Water Distribution Systems.” Environmental Science & Technology, vol. 48, no. 8, 2014, pp. 4332–4339., doi:10.1021/es405145f.
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[5] “Chloramines and Copper Pipe Corrosion.” Water Research Foundation,
[6] “Chloramines and Copper Corrosion in Drinking Water Distribution Systems.” Environmental Science & Technology, vol. 48, no. 8, 2014, pp. 4332–4339., doi:10.1021/es405145f.
[7] “The Impact of Chloramines on Copper Piping.” Plumbing Engineer, vol. 16, no. 2, 2015, pp. 64–68.
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[9] “Chloramines and Copper Corrosion in Drinking Water Distribution Systems.” Environmental Science & Technology, vol. 48, no. 8, 2014, pp. 4332–4339., doi:10.1021/es405145f.
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