

## **Chemical Compatibility and Impact Analysis of HYTREAT 5700 and Aqua Shield 221**

### **Potential Reactions**

#### **1. Chemical Neutralization and Functional Incompatibility**

HYTREAT 5700 relies on sodium molybdate and tolyltriazole to provide anodic and cathodic corrosion inhibition under controlled chemical conditions. Aqua Shield 221, as a sulphite-based oxygen scavenger, introduces strong reducing agents into the same medium. When mixed, sulphite ions can chemically interfere with molybdate species by altering the redox balance of the solution. This interaction disrupts the passivation mechanism of molybdate on metal surfaces, resulting in the partial or complete neutralization of corrosion protection performance. As a result, the mixture fails to function as either an effective corrosion inhibitor or a reliable oxygen scavenger.

#### **2. Destabilization of Metal-Inhibitor Surface Films**

Tolyltriazole in HYTREAT 5700 is designed to adsorb selectively onto copper and copper-alloy surfaces to form a stable protective film. The presence of sulphite-based compounds from Aqua Shield 221 competes for adsorption sites and alters the electrochemical conditions at the metal-solution interface. This competition weakens the integrity of the triazole-derived film, causing discontinuous surface coverage. Such destabilization increases susceptibility to localized corrosion, particularly under fluctuating oxygen conditions, which contradicts the intended purpose of both formulations.

#### **3. Formation of Reactive Sulfur Species and Secondary Corrosion Risk**

Sulphite-based oxygen scavengers are prone to oxidation into sulfate or intermediate sulfur species when exposed to metal catalysts and trace oxygen. In the presence of molybdate and triazole compounds, these sulfur species can participate in secondary reactions that promote under-deposit corrosion or crevice corrosion. The resulting chemical environment may accelerate metal attack rather than suppress it, especially in low-flow or stagnant sections of the system. This phenomenon represents a significant operational risk in closed-loop or boiler-related applications.

#### **4. Loss of Process Control and Monitoring Reliability**

Each product is formulated to operate within specific analytical control parameters. Mixing HYTREAT 5700 with Aqua Shield 221 alters key indicators such as residual sulphite, molybdate concentration, and oxidation-reduction potential (ORP). This overlap compromises routine monitoring methods, making it difficult to accurately assess chemical dosage and system health. Consequently, operators may unknowingly overdose or underdose treatment chemicals, leading to inefficient operation, increased chemical consumption, and elevated maintenance costs.

### **Mandatory Control Measures**

#### **1. Absolute Prohibition of Direct Blending**



HYTREAT 5700 and Aqua Shield 221 must never be mixed directly in storage tanks, day tanks, or common transfer containers. Their chemical functions are inherently incompatible, and direct blending eliminates the effectiveness of both products. Each chemical must be handled as an independent treatment component in accordance with its specific technical data and application guidelines.

## **2. Physical Separation of Storage and Dosing Systems**

Dedicated storage tanks, dosing pumps, and injection lines must be used for each product. Aqua Shield 221 should be introduced upstream or at a location distinct from HYTREAT 5700 to ensure sufficient dilution and reaction time within the system. Physical separation minimizes the risk of high-concentration interaction and preserves the intended performance of each formulation.

## **3. Controlled Sequencing and Injection Timing**

If both chemicals are required within the same process system, a clearly defined dosing sequence must be established. Adequate residence time must be allowed after Aqua Shield 221 injection before HYTREAT 5700 is introduced. This approach reduces the likelihood of direct chemical interaction in concentrated form and supports stable system chemistry.

## **4. Enhanced Monitoring and Analytical Segregation**

Separate analytical control parameters should be maintained for sulphite residuals and molybdate/triazole concentrations. Operators must avoid using single composite indicators to evaluate system performance. Routine sampling points should be strategically placed to distinguish the individual effects of each chemical, ensuring accurate control and timely corrective action.

## **5. Technical Review and Documentation Update**

All operating procedures, chemical compatibility matrices, and training materials should be updated to explicitly identify HYTREAT 5700 and Aqua Shield 221 as incompatible for direct mixing. A formal technical review involving chemical suppliers or water treatment specialists is strongly recommended to validate dosing strategies and prevent future misapplication.

