Water Quality
AQUATEC
ENGINEERING
THE WATER SPECIALIST
PT. AQUATEK ENGINEERING

+ 62 811 3037 533
aquatek.bryan@gmail.com
Ruko Bandar Mas Blok E No. 10

Chemical Compatibility and Impact Analysis of HYTREAT 5700 and Sulfuric Acid

Potential Reactions

1. Precipitation of Insoluble Molybdic Acid and Loss of Corrosion Inhibition

The immediate chemical consequence of mixing HYTREAT 5700 with concentrated sulphuric acid (98.2%) is the protonation of sodium molybdate, resulting in the formation of molybdic acid. Under highly acidic conditions, molybdic acid exhibits extremely low solubility and rapidly precipitates as a solid phase. This precipitation removes molybdate ions from the solution, converting the treatment fluid into a corrosive slurry and completely eliminating its anodic corrosion inhibition function. The formation of solid deposits also introduces a high risk of line blockage and mechanical fouling within dosing systems.

2. Protonation and Functional Collapse of Tolyltriazole Protection

Tolyltriazole provides corrosion protection through adsorption onto copper and copper-alloy surfaces via nitrogen coordination bonds. Exposure to concentrated sulphuric acid leads to protonation of the triazole ring, disrupting its electronic structure and preventing effective surface binding. Once protonated or chemically altered, tolyltriazole can no longer form a stable protective film, leaving yellow-metal components fully exposed to aggressive acidic attack. This mechanism significantly accelerates corrosion of copper-based heat exchangers and ancillary equipment.

3. Severe Exothermic Hydration and Thermal Instability

Sulphuric acid at high concentration is a powerful dehydrating agent that releases substantial heat upon contact with aqueous media. Since HYTREAT 5700 is formulated in a water-based carrier, their interaction triggers an intense exothermic hydration reaction. The rapid temperature rise can cause localized boiling, steam generation, and violent splashing of the corrosive mixture. This thermal instability dramatically increases the risk of severe chemical and thermal burns to personnel and may compromise the integrity of nearby equipment.

4. Accelerated Electrochemical Corrosion and Hydrogen Evolution

The resulting mixture combines extreme acidity with elevated ionic conductivity, creating a highly aggressive electrochemical environment. In the absence of functional molybdate and triazole inhibitors, metallic surfaces undergo rapid anodic dissolution accompanied by hydrogen gas evolution. This process leads to accelerated wall thinning, pitting corrosion, and increased susceptibility to mechanical failure. Compared to sulphuric acid alone, the presence of dissolved salts further intensifies corrosion kinetics, increasing the likelihood of catastrophic equipment failure.

5. Formation of Hazardous Acidic Aerosols and Unpredictable Toxicological Profile

+ 62 811 3037 533
aquatek.bryan@gmail.com
Ruko Bandar Mas Blok E No. 10

The thermal energy released during mixing may aerosolize sulphuric acid droplets together with partially decomposed organic residues from HYTREAT 5700. This results in the formation of a dense acidic mist with a poorly defined toxicological profile. Inhalation of such aerosols poses a severe risk to the respiratory system, potentially causing pulmonary edema, mucosal burns, and long-term lung injury. The uncertainty associated with mixed decomposition products significantly complicates emergency response and re-entry decisions.

Mandatory Control Measures

1. Immediate Evacuation and High Level Respiratory Protection

Because of the risk of toxic acidic mists and steam explosions, the immediate area must be evacuated in a crosswind direction. Standard surgical masks or basic respirators are insufficient for this event. Responders must utilize a Self Contained Breathing Apparatus (SCBA) to protect against high concentration acidic vapors. A safety exclusion zone should be established and clearly marked to prevent unauthorized access until the atmospheric hazards have been fully mitigated and verified by safety officers.

2. Utilization of Acid Resistant Personal Protective Equipment

Personnel tasked with managing the mixture must wear specialized PPE that meets Category 1A skin corrosion protection standards. This includes fully encapsulated acid suits made of materials like PVC or Viton, as 98.2% Sulphuric Acid will rapidly penetrate standard clothing and even some types of rubber. Double gloving with chemical resistant nitrile over neoprene and the use of a full face shield over chemical goggles are mandatory to prevent any possibility of direct contact with the corrosive slurry.

3. Staged Neutralization Using Solid Alkaline Buffers

Directly adding liquid water to neutralize this mixture is strictly prohibited due to the risk of violent splattering. Instead, the remediation team should apply solid neutralizing agents such as soda ash (sodium carbonate) or calcium carbonate in a slow, controlled manner. These solids help absorb the liquid while gradually raising the pH. The process must be monitored with infrared thermometers to ensure the heat of neutralization does not trigger further vapor release, and the neutralization should continue until the mixture reaches a stable pH between 6 and 9.

4. Hazardous Waste Segregation and Documentation

Once the mixture is stabilized, the resulting sludge must be treated as hazardous waste due to the presence of Molybdenum and residual acidic components. It should be collected using non metallic, acid resistant shovels and placed into high density polyethylene (HDPE) drums. These containers must be labeled with the exact contents, including the CAS numbers for Sulphuric Acid (7664-93-9) and Sodium Molybdate (10102-40-6), as required by international hazardous waste regulations. A manifest must be generated to ensure the waste is processed by a licensed facility capable of handling toxic metal salts and corrosive residues.