



WORLD CLASS MOLYBDENUM & TUNGSTEN COMPOUNDS

Since 1921

MOLYBDATE FOR CORROSION INHIBITION

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Customer Services Bulletin

Corrosion Inhibition:

In 1939, two patents first described the use of readily soluble sodium, potassium, and ammonium molybdates as corrosion inhibitors for motor vehicle engine coolants. These and other inorganic molybdates are now among the most popular corrosion inhibitors because of their favorable properties and behavior. Molybdate is an anodic inhibitor, i.e. it inhibits by increasing the polarization of the anode component of the metal corrosion cell. Basically, Molybdate forms a transparent passivating film that inhibits the corrosion of ferrous, aluminum, and cupreous metals over a wider pH range than any other inhibitor apart from chromate. It does this by precipitating escaping metal cations as molybdate species to block anodic sites and strengthen developing metal oxide films. Furthermore, molybdate does not lose its chemical properties and effectiveness when it encounters 'hot spots' or increased temperatures; nor does molybdate breakdown in chlorinated systems or when chlorine is used as a biocide like other inhibitors (e.g. Belcor 575).

Molybdates are seldom used alone because the concentration level required for effective corrosion retardation make it commercially unattractive (e.g. 250 mg/L) – as with other anodically active inhibitors, molybdate efficacy is improved and its concentration requirement significantly reduced when it is combined with other synergistic chemicals. Among the best known of these synergists are amines (e.g. Cyclohexylamine, DEAE), phosphonates (e.g. HEDP, PBTC), azoles (e.g. tolyltriazole, benzotriazole), and soluble zinc salts (e.g. zinc sulfate).

The largest consumption of molybdates for corrosion inhibition is in the treatment of cooling water in open and closed cooling systems. Commercial water treatment programs commonly employ molybdate with as many as four or five other

components to inhibit and/or control corrosion, algae & microorganism growth, pH regulation, and scale or solids dispersion. A typical formulation of a copper corrosion inhibition treatment that has retarded corrosion to a rate of 0.021 mils/yr. follows:

| | |
|------------------------------------------|---------------|
| Sodium tolyltriazole 50% solution | 1 mg/L |
| Sodium molybdate dihydrate | 5 mg/L |
| HEDP | 3 mg/L |
| Zinc sulfate | 2 mg/L |

Other products and processes which utilize molybdates include hydraulic & metalworking fluids, temporary rust-preventive coatings, pitting inhibitor for stainless steels in mineral acids, passivation treatments for galvanized zinc and tin plate, rinses for phosphate conversion coating, aluminum anodizing processes, hot forging lubricants, boiler waters, engine coolants, as well as many others.



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