



Aquamet[®] products



Technical Service Guide

Nouryon



Aquamet products

Technical service guidelines for use in wastewater treatment systems.

Aquamet® E

(Sodium Diethyl-dithiocarbamate)

- It has a better aquatic toxicity than Aquamet M.
- It is a good alternative dithiocarbamate for situations where dimethyl-dithiocarbamate use is restricted.
- It forms a larger metal complex, which agglomerates and settles more readily than Aquamet M; but it can sometimes still form "floaters" on the water surface.
- It reacts differently for some metals than Aquamet M. It has been observed in laboratory tests that Aquamet E is more successful at removing certain precious and semi-precious metals than the other products. It is also more effective at removing heavily chelated electrolysis nickel or chromium.

Aquamet® M

(Sodium Dimethyl-dithiocarbamate)

- The most cost effective product.
- The most forgiving during application.
- It is the most durable in acidic or oxidizing environments and will not degrade as easily as the other materials. This property makes it a better choice for low pH conditions, such as when the pH is lowered to help free the metal from a strong complexing or chelating agent.
- It agglomerates well, but can sometimes tend to form "floaters" on the water surface.
- The most toxic of all three Aquamet products.

Aquamet® T

(Sodium Trithiocarbonate)

- It is not a dithiocarbamate.
- It forms a denser sludge than the other products, with less volume and weight, which can result in lower sludge disposal cost.
- The agglomerated sludge is more fragile and can re-disperse into much smaller particles, which do not settle out well. This problem can be easily overcome, however, by the addition of a coagulant.
- It is the most susceptible to degradation in acidic or oxidizing environments, and could require slight overdosing to compensate for this loss.
- It has the least aquatic toxicity than Aquamet E or Aquamet M.

Features and benefits

Aquamet products precipitate complexed and/or chelated metals and mixed metals, such as copper, nickel, zinc, chromium, cadmium, silver, lead, iron, and mercury. The resulting metal complex is extremely water insoluble and readily precipitates out in solution.

This precipitate forms a dense, compact, chemically stable sludge, that settles rapidly and can be easily dewatered. This lower volume sludge offers lower disposal costs and can be disposed of by direct incineration, permitting precious metal recovery.

The Aquamet products minimize settling and clarification time in polish systems that are not effectively treated by alternative precipitation techniques, such as sulfide, sulfate, or hydroxide precipitation.

These products function effectively at lower pH levels than those required for traditional hydroxide precipitation. The Aquamet products are chelating agents and can take metal away from most other chelating agents.

Aquamet products also act as reducing agents. They can reduce Cr^{6+} to Cr^{3+} .

Product dosing

- Aquamet products react stoichiometrically. If the total concentration of metal(s) is known, then the user can calculate the dosage precisely, using the factors supplied in the product literature.
- A correct Aquamet dosage cannot be recommended without quantification of ALL of the metal concentrations in the water matrix.
- Treat waste water by adding directly to a batch of water or by adding a continuous feed of Aquamet to the waste water stream (gal/day). The customers should be fairly familiar with the total metal loading of the stream; however, if the stream load is not constant it will require adjustment for "off-peak" periods.
- Jar testing should always be conducted before any product is dosed into an industrial system.

Troubleshooting

Following is a guide for those cases where metals are not completely complexed.

1. Is the customer adding the correct amount of Aquamet? If yes, then...

2. Have they accounted for EVERY metal in their water? If yes, then...

3. Have they tried a coagulant, such as alumina at 10-20 ppm? If yes, then...

4. Are there any complexing and/or chelating agents in the water? Aquamet products may or may not remove metals from complexing or chelating agents. It depends on the agent used, its concentration, and pH. Adjusting the pH down can weaken the metal's bond with some agents, helping to free up the metal to complex with the Aquamet.

Common complexing agents that could interfere with the metal precipitation reaction are:

- Phosphates
- Phosphoric Acid (PA)
- Monosodium Phosphate (MSP)
- Disodium Phosphate (DSP)
- Trisodium Phosphate (TSP)
- Sodium Cyanide
- Ammonia

Cyanides usually pose two problems. The first is that it is very difficult for the Aquamet to remove the metal from the cyano complex. The second is that oxidizers are generally present to destroy the cyanide, which will, in turn, destroy the Aquamet. The best recommendation in these circumstances is to successfully destroy all of the cyanide first, then destroy all of the oxidizer, and then finally add the calculated dosage of Aquamet.

Some common chelating agents that could interfere with the metal precipitation reaction are:

- Sodium Ethylenediaminetetraacetate (EDTA)
- Sodium Nitrilotriacetate (NTA)
- Sodium Gluconate
- Sodium Glucoheptonate
- Citric Acid and its derivatives
- Acetic Acid
- Tartaric Acid
- Glycolic Acid
- Phosphonates
- Aminomethylene Phosphonate (AMP)
- Hydroxyethylidene Diphosphonate (HEDP)
- Phosphonobutane Tricarboxylic Acid (PBTC)
- Polyphosphate Salts
- Sodium Tripolyphosphate (STPP)
- Sodium Hexametaphosphate (SHMP)
- Tetrasodium Pyrophosphate (TSPP)
- Tetrapotassium Pyrophosphate (TKPP)

5. What is the pH of the water?

If it is less than 7.0, then some of the Aquamet could be degrading especially when there is a strong complexing or chelating agent present metal. If this is the case, then overdosing may be needed to compensate for the degradation. If no complexing or chelating is known to be present, then raising the pH may improve the removal performance.

6. Are there any strong oxidizers present in the water?

If so, then some of the Aquamet could be degrading. If this is the case, then overdosing may be needed to compensate for the degradation.

Residual product analysis

There are two methods for determining residual Aquamet product in solution. The best way to avoid residuals is to have accurate knowledge of the total metal concentration in the water and add the correct corresponding dosage of Aquamet, thus avoiding any overdosing situation.

1) EPA Method 630

This method is for the determination of dithiocarbamate pesticide concentrations in wastewater. It may or may not be capable of modification for trithiocarbonate analysis. This method is the only method approved for determining whether or not the discharge levels are safe.

2) Laboratory Testing

This method is only recommended for situations where it is known that the Aquamet is performing as expected and all metals have been removed from the waste water in question.

- I. Make up a 10.0mg/L copper solution, using CuSO_4 .
- II. Add 50mL of the copper solution to 50mL of the treated wastewater suspected of having residual Aquamet.
- III. Mix well and let the sample sit a few minutes.
- IV. Filter the sample through a 0.45 μm filter.
- V. Repeat the first two steps, using DI water in place of the wastewater to use as the total.
- VI. Measure the concentration of copper in the two samples.

If no Aquamet is present in the wastewater, then the concentration should be equal to the total solution prepared in step five, which should be approximately 5.0mg/L Cu. If there is less in the wastewater sample, then the difference from the total solution's concentration will be the amount of metal that was removed by precipitation with any remaining Aquamet. This concentration can then be multiplied by the same factor used in dosing in order to determine the approximate residual Aquamet concentration. For copper, this factor would be 4.51.

Destroying excess Aquamet product

There are three ways to destroy excess Aquamet within a system. They are listed here in order of preference. It is crucial that all residual dithiocarbamate and trithiocarbonate be removed before discharge. The dithiocarbamate and trithiocarbonate metal complexes are toxic, and are stable under acidic conditions.

Metal precipitation

The addition of a metal compound, such as FeSO_4 , will react with any excess Aquamet. This reaction will form the metal complex and precipitate out as sludge. Any remaining iron can be removed by raising the pH to precipitate $\text{Fe}(\text{OH})_3$.

Oxidation

All of the Aquamet products are fairly strong reducing agents and are easily oxidized with hydrogen peroxide, bleach, ozone, or another commonly used oxidizer. Hydrogen peroxide is preferred for oxidation. Add it until a sustained oxidation-reduction potential (ORP) is obtained. Ozone has also been found successful. Bleach is effective, but poses additional concerns. Air will oxidize the Aquamet, but the rate of reaction is unknown and expected to be slow.

Acid decomposition

Caution: This method will yield the starting amine and carbon disulfide. Carbon disulfide is explosive and highly toxic. This method should only be conducted in a well ventilated area and is only recommended for small volumes of wastewater with only a few mg/L of Aquamet present.

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