FACT SHEET

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- Metal Finishing Series -

Identifying and Reducing Contamination in Metal Cleaning, Plating, and Rinsing Baths

This fact sheet is one in the Metal Finishing series produced by the North Carolina Division of Pollution Prevention and Environmental Assistance (DPPEA). The series also includes In-Tank Filtration Systems; Bag In-Tank Filtration Systems; Cartridge In-Tank Filtration Systems; and Disc In-Tank Filtration Systems. These fact sheets are designed to assist industry professionals and others interested in waste and cost reduction opportunities associated with fabricated metal operations. Please contact DPPEA for assistance further information.

Background

In the fabricated metal products industry, a constant priority is to limit process bath contamination, whether in a cleaning, plating or rinsing bath. Contaminants in these process tanks lead to problems with final product quality. When the impurity level in a process tank reaches a point at which product quality is affected, the solution is replaced or treated for reuse. It is possible for metal finishers to decrease the frequency of solution replacement or batch treatment through the use of simple solution preservation techniques and continuous in-tank filtration systems.

Sources of Metal Cleaning and Plating Bath Contaminants

There are four basic types of contaminants that occur in plating/cleaning solutions:

- Particulates: any solid material suspended in the solution.
- Organics: mineral oils, animal fats, vegetable oils and some salts.
- Inorganics: rust, tarnish, salts.
- Micro-organisms such as bacteria and fungus.

These contaminants lead to coating defects such as pitting peeling and blistering. The following list includes some common sources of these contaminants:

1. Inorganic salts that result from substrate dissolution.
2. Oxides (i.e., rust), tarnish, and abrasion particles that fall from the surface of the metallic part.1
3. Particulates, inorganic salts, and organic salts present in tap water that are transferred to the bath during makeup or refill.
4. Dust particles that originate from the air circulating over the bath. Airborne dust and soot are sources of organic or inert particluates.
5. Fumes, oil mist, vapors, dust, and any other contaminants that get past the intake screens[1] and are absorbed in the bath solution. A plating bath can act as a fume scrubber when air is pumped through it to provide agitation.
6. Sludge derived from the decomposing anode that builds up in the solution over time and forms inorganic particles.
7. Lubricants used in machinery (i.e., hoists) such as mineral oils, animal fats, and vegetable oils that can leak into the bath or be transferred in from other baths in the production line.
8. Resins that can bleed out of the production equipment.[2]

9. Wetting agents that are carried from the cleaning line to the plating electrolyte. The electrolyte, aided by the wetting agent, attracts organics entering the tank. For example, oils emulsified by wetting agents are transferred into the bath and subsequently dispersed throughout the solution where they cling to the parts. These oils cause peeling or spotting.'
10. Microorganisms and fungus growth that are associated with stagnant or poorly agitated solutions.
11. Microorganisms that can contaminate a bath containing lubricants.

Many of these contaminants can range in size from greater than 100 microns to submicron levels. While contaminant prevention techniques can successfully reduce any range of contaminants, advanced filtration and/or other treatment technologies used for recovery are successful according to the size and physical characteristics of the contaminants.

Methods for Reducing Contaminant Build Up

Batch or continuous treatment (i.e., chemical treatment, porous pot, ion exchange, ultrafiltration, etc.) of a process solution to remove impurities is often more efficient than disposing of it, but additional low-cost methods can prevent build up of impurities that decrease the life of a process solution. Some of these techniques to reduce the build up of impurities and increase the solution life include the following:

ReduceDragout: By reducing solution dragout or drag in between tanks, the preceding solution and contaminants are less likely to be transferred between stages in the operation. Drag-out can be reduced by ensuring that as much solution as possible is removed from the part before it moves onto the next tank. Simple approaches include increasing the drip time between baths, blowing solution off parts with low-pressure air (i.e., air knives), applying fog or spray rinse over the plating tank, installing drain boards between tanks, and increasing bath temperature to reduce the viscosity of the plating solution.

Reduce Bath Strengths: By optimizing the wetting agents used in the cleaning tanks, contamination of the plating tanks can be reduced.

Use Deionized Water: The use of deionzed or treated water in both solution makeup water and rinse water will prevent the introduction of contaminants associated with tap water.

Rinse Efficientlv: Controlled, efficient rinsing will ensure that all parts are washed free of solution before they move to the next tank in the plating process and also ensure efficient use of water. The use of flow and conductivity controllers can provide efficient rinsing.

Use Conductivity Controls: Automated conductivity controls can be used to prevent contaminant build up; these controls will automatically add fresh water to a tank when the contaminant level reaches a preset level of electrical conductivity.

Operate Still Tanks: Still tanks can reduce plating contaminants that enter the rinsing system. These still rinses can be used to make up plating solution.

Install In-Tank Filtration: Organic particles often enter a plating/cleaning tank at sizes of about 75 microns. Once in the agitated bath, however, these particles will begin to break down. As a result, the sludge originating from these materials accumulating at the bottom of the tank is about 1 micron in size. However, sludge treatment and removal is an expensive and labor-intensive operation. A continuous in-tank filtration system will remove these contaminating particles before they have a chance to break down and form a sludge. In-tank filters can remove particulates above 1 micron in size.

The North Carolina Division of Pollution Prevention and Environmental Assistance provides free, non-regulatory technical assistance and training on methods to eliminate, reduce, or recycle wastes before they become pollutants or require disposal. Telephone DPPEA at (919) 715-6500 or 800-763-0136 or e-mail nowaste@owr.ehnr.state.nc.us for assistance with issues in this Fact Sheet or any of your waste reduction concerns.

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[1]**Nargi, Carmine. "Preparing Metals for Plating," Product Finishing. 1990. p. 108.**
***Berg, Jean. "Filtered Thoughts." Serfilco Technical Bulletin. 1987. p. D4.**