

Safety in the Process Line

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Safety is the main subject in this paper. I would like to review an area that is very important to any process line, no matter how big or small, manual or automated. This interest specifically points to selecting the types of chemical process baths and treatments that are available. The user may acknowledge benefits from either or both. In any case, the available selections are tried and true, in their respective applications. For the use of all the materials discussed, adherence to vendor recommendations in their technical literature, drum labels, and MSDS, are a big step in safety.

Surface Preparation

Alkaline Cleaning

Two types of product concentrates are widely used for soak and electrocleaning: powdered and liquid cleaners. Both systems contain similar additives such as: alkalinity builders, buffers, surfactants, wetting agents, descalers, water conditioners, and inhibitors. The cleaning dynamics and bath service lives are comparable. Operating costs up front are similar. Although looking at the total picture, liquid cleaners are more economical (much less sludging, easier make up, easier to add, less down time, sometimes easier to waste treat). These benefits, as will be noted, also include enhanced safety.

By comparing actual safety issues, the following practical facts can be readily confirmed for powdered cleaners:

- Usually supplied in fiber drums. Through mishandling or storage problems, the drums can crack open, spilling corrosive contents, resulting in major personal safety issues.
- Aging drums of opened or unopened cleaner tend to harden (moisture absorption). Clumping of product concentrate makes it very difficult to remove the contents when making additions. I have seen shovels and pick axes at work, causing broken off clumps to fly in varying directions. Some innovators have even suspended drums above a tank. Cutting away the drum resulted in “boulders” of the cleaner tumbling into the process tank.
- Empty drums must be properly disposed to avoid tying up plant floor space.
- Manual additions may give rise to dustiness, with fine powders settling on unprotected skin, causing burns and rashes.
- Additions must be made in gradual steps, to avoid possible splash back, due to localized boiling of added cleaner.
- Good mixing is essential to prevent formation of un-dissolved clumps that settle to the bottom of the tank. Care must be taken to avoid splashing and spray. The paid for concentrate in this case pays no dividend.
- Cleaner spilled on the catwalk picks up moisture, quickly forming a slippery condition.
- Portions of un-dissolved cleaner along with sludging, makes for more time consumption to clean out the tank and worker safety issues.

These safety problems are not meant to be an indictment of powdered cleaners. For decades past, the present, and into the future, powdered cleaners comprise the first, critical step in many process cycles. Finishers have successfully used powdered cleaners and will continue to do so, acknowledging these safety issues associated with their usage. OSHA and related government agencies along with insurance carriers put more focus and emphasis on safety. This is good for everyone.

Liquid Cleaners were not only developed to meet the rigorous cleaning applications that powdered blends excel at. In fact concentrated liquid blends have focused on significant advantages offered to the finisher, which do encompass improved safety. These include the following points:

- Supplied in rigorous polyethylene drums and bulk sizes of totes. The drums better withstand handling versus the fiber drums. Totes are placed inside a protective mesh metal cage.
- The concentrated liquid blend cannot harden with time. However protection from freezing temperatures is required.
- Liquids eliminate the problem of dustiness. However spillage is a problem. Burns, rashes, and slippery floors are a concern.
- Additions can be made directly from a drum pump to the process tank, eliminating exposure and handling of the product. The drum or tote can be stored safely away from the cleaner tank and contents automatically added by a pump activated by a conductivity meter.
- Liquid blends are 100% mixed and will not agglomerate or clump on addition to the process tank. Moderate, thorough mixing of additions in the tank is quite simple, minimizing splashing.
- Clean out of the tank after dumping the liquid cleaner bath is simpler and safer, due to much less sludge removal.
- Empty drums may be recycled. Totes are generally returnable, thus making them truly recyclable.

Liquid cleaners have found a niche, operating in many cleaning lines. They also provide an important first step in the surface preparation of parts. Although total safety is never 100% guaranteed, the use of liquid cleaners does provide the finisher overall significant safety advantages when compared to powders.

Acid Treatment

In somewhat of a twist, let us consider the use of liquid acids versus powdered acids. Both are essential to cleaning, descaling, derusting, and overall activation of the surface, before plating or other process. One system employs generic acids while the other provides salts of acids that ionize when dissolved in water. Both processes adequately condition the surface. Each incorporates a degree of safety issues related to their chemical use. Acids are acids and must be handled with the appropriate caution and safety procedures.

Liquid Acids

These would usually refer to hydrochloric and sulfuric. To a lesser degree: phosphoric and acetic. Since hydrochloric and sulfuric are most commonly used, these two acids will be referenced. Safety related issues include:

- By nature of the materials, their corrosiveness. Rapid, severe burning of exposed skin. Hydrochloric acid concentrate fumes.
- Additions to tanks must be made gradually to cold water, with good mixing. **Acid to water!** Sulfuric acid is especially exothermic, rapidly giving off lots of heat, resulting in localized boiling and splash back.
- Pickling and activation of the metal surface results in corrosive fumes that must be properly vented.
- Sometimes mixed acids are required, such as for desmutting aluminum. In this case handling nitric, sulfuric, and hydrofluoric acids, in specific combinations, or together.
- Extreme care is necessary to prevent potentially catastrophic accidents.
- Empty carboys, drums, and totes of acids should be returned for refill promptly. Reducing hazard clutter is important to handling safety.

Liquid acids are used in many finishing and waste treatment applications, on a continual daily basis. The inherent safety related issues are well known. Trained personnel, using proper technique and precautions, handle and use these acids generally without harmful effect. Generic acids will always have a place in metal finishing, because of their importance to specific surface treatments. Safety in understanding the materials and how to handle them will always be very important.

Powdered acids have been available to finishers for many years. This line of products were specifically developed to increase the effect of acid treatments in a safer handling situation. Powdered acids offer several advantages with respect to improved safety. Some of these are:

- Acid salts that upon dissolution, ionize to provide active acid in the bath. Common among these is Sodium Bisulfate, the acid salt of sulfuric acid. The safety benefit is eliminating the handling of sulfuric acid, and its accompanying exothermic heating.
- Acid salts are blended to offer additional acid accelerators in the form of chlorides and fluorides. These agents also ionize in solution, providing hydrochloric and hydrofluoric acids. One concentrate product can eliminate the handling of two or three separate generic acids. This is another safety benefit.
- Unlike liquid acids, the powdered acids may contain surfactants and wetting agents. These allow for improved penetration for surface action. This could result in using fewer products compared to a higher concentration of liquid for the same application. The less to handle, the safer should the situation become.
- Surfactants and wetters in the powdered acids form a stable, light foam blanket. This may effectively eliminate over 99% of potentially corrosive fumes and mists.



Better Chemistry. Better Business

- The powdered acids are supplied in fiber drums. Caking and hardening on aging and storage in humid conditions may occur. Appropriate handling and storage precautions should be followed. However the storage, handling, and shipping of empty liquid acid drums is eliminated.
- Powdered acids may contain special inhibitors, such as to prevent immersion deposits, thereby extending the bath service life. These products are also buffered, to provide longer functioning acid action over time. The benefits include less frequent solution dumps means less handling requirements.

Powdered acids offer several safety advantages with respect to handling and use. These benefits along with improved performance have kept these products very popular among finishers. Activation is the next important step after cleaning in the surface preparation sequence. Generic acids and powdered acids can get the job done. Where safety and handling in use are concerned, powders offer an advantage.