Water Technology

Using demineralization as a water saving device

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Feature
Profile of a treatment system for an ammunitions plating application.

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The variety of industries that need demineralized or deionized (DI) water for production is vast. Metal finishing and electroplating constitutes an appreciable percent of those users.

These companies need DI water for makeup, rinsing and solution preparation. Flow demand is typically on the low side, making these installations good opportunities for dealers to service by providing capital equipment or portable exchange.
A growing concern among the metal finishing industry is the minimization of wastewater production and discharge. Today, metal finishers are coming under increasing scrutiny from local, state and federal regulatory agencies.

Application for plating

American Ammunition (AA), a Miami-based company that makes cartridges and bullets, uses DI water exclusively for its plating operations. They incorporate special techniques to minimize both DI water consumption and generation of wastewater.
A bullet is made up of two basic components - the cartridge and the projectile. The projectile is often referred to as the bullet.
Historically, the projectile was made entirely of lead because it is malleable, easy to work with and contains many properties that make it an attractive projectile material.
Most bullets today are covered with a copper coating that reduces lead fouling of the bore (inside of the barrel) of the firearm and also minimizes the release of lead into the environment - an important consideration while hunting or target shooting outdoors.

A typical dual-bed deionization system recirculating process rinse water.

System facts

1. 240,000 pounds of projectile material were processed in the last six months.
2. The wastewater sent to the local sewerage authority was only 1,600 gallons or 0.007 gallons of wastewater per pound of material processed.
No metals were present in the wastewater - only salts.
The wastewater was produced mostly from resin regeneration and process solution replacement. The process solutions included activators and antitarnish dips.
3. The effective use of spray rinsing in "dragout" tanks allows for 99 percent-plus recovery of process solution dragout. The key is to use DI water only to avoid buildup of dissolved solids on the parts or in the rinse tanks.
The dragout from spray rinses is directed back to the source tank to make up for evaporative losses.
4. All process solutions/rinses must be made up with DI water. The influent water source is city water. The water is passed through a cation resin bed in the hydrogen form, followed by an anion resin bed in the hydroxide form.
The cation bed removes the calcium, magnesium, sodium and iron from the city water. The anion bed removes the sulfates, chlorides, alkalinity and silica from the water.
The water quality is in the range of 5 ppm, primarily made up of sodium and low amounts of silica.
5. Plating line water consumption is only for makeup and replacement of evaporative losses (primarily from spray rinses). Typical daily consumption is 100 gallons.
6. The system is designed for zero discharge from the plating line rinse tanks. This is a key element of the attractiveness of this system.
To illustrate the effectiveness of a zero discharge design, consider a conventional copper plating system where rinse water consumption of 8 to 16 gpm (three cascade rinse tanks plus one single-tank rinse station at 2-4 gpm) over an eight-hour day would generate more than 3,800 gallons of process rinse water requiring pretreatment prior to discharge to the POTW (Publicly Owned Treatment Works).
The zero-discharge philosophy eliminates the liabilities introduced by the conventional system where metal-bearing wastewater must be pretreated before discharge.
The required pretreatment system for conventional rinsewater systems can be costly and difficult to operate.
7. There is virtually no contaminant carryover to process chemistry in downstream tanks. Careful use of DI water and maintaining a very low TDS in the rinse tanks provides clean and long-lasting process chemistry.
8. This system provides major cost savings due to low municipal water and sewer expenses. Each gallon of water saved actually represents two gallons saved because water usage in a plant is paid for twice - once by the municipal water provider and once by the wastewater receiver (POTW).
9. Effective use of the spray rinse system saves water consumption and keeps the DI water demand low. This leads to long DI system run times, less frequent regenerations, and consequently less wastewater produced.

Closed loop systems, coupled with effective DI spray rinse equal low deionization loading on tanks and cost savings, versus deionizing municiple water to achieve the same level of rinse water purity.

10. There are major cost savings to be realized due to the extended process chemistry life. The plating process chemistry is affected by whatever contaminants are introduced by the makeup water or drag-in water (water dripping off parts).
The absence of drag-in water to the process chemistry equals long run times and less chemical usage.

11. One of the greatest benefits to this type of system is the simple and trouble-free compliance with local, state and federal discharge requirements. No process rinsewater discharge means reduced compliance monitoring.
Closed loop rinses allow for batch treatment of hazardous wastes and very little batch treatment is required.

Special techniques are used at American Ammunition to minimize DI water consumption and wastewater.

Dealer opportunities

Opportunities for the water treatment dealer at plating operations are two-fold. The easiest entry into this field is by providing DI water to the clean side of the operation.
The □clean□ side is the treatment of city or well water only. No metal bearing waters come in contact with this equipment. No hazardous materials can accumulate on the resin.
Dealers can sell the plater an in-house regenerating system, or provide DI water through portable exchange.
The other opportunity for a dealership is to provide an exchange service for the rinse recycle.
Dealers can team up with one of several resource recovery/resin regeneration companies that are licensed to accept exhausted resins from metal finishing operations. The resin tanks are sent off-site to a central regeneration facility.
The benefit of off-site regeneration is not needing to operate the complicated regeneration cycle, not handling chemicals, and not having to treat the wastewater produced during regeneration.
The disadvantage of off-site regeneration is in higher capital cost, since at least two and probably three trains of ion exchange systems are needed - one on-line, one in stand-by and one out for regeneration.
Also, from a timeliness and effectiveness standpoint, the plating shop is somewhat at the mercy of the regenerator.
Off-site regeneration is often significantly more expensive than in-place regeneration, at least from a direct chemical and labor standpoint.

AA's system is designed for zero discharge from the plating line rinse tanks.

In-place regeneration allows complete control over the process and generally requires less capital expense, not including waste treatment. However, the process of in-place regeneration requires a relatively sophisticated technician to operate the system and results in a fairly significant volume of waste liquid that is highly concentrated and must be further treated prior to disposal.

Summary

When properly designed and operated, zero discharge DI/rinse recycle systems provide two major benefits. They eliminate the need to discharge wastewater that might contain hazardous contaminants and they generally provide a better quality rinse environment and a more stable condition.

As time goes on, there will most likely be a larger network of dealers to service this industry on the operation and maintenance of these systems.

This environmentally sound technology and philosophy provides superior process rinsewater, improving plating yields.

The plating of projectiles demands tight tolerances and the plating thickness and distribution are critical. The system at AA is designed to meet the stringent product specifications (many jobs are for the military) by judicious use of DI water throughout the operation and the recycle of treated rinse waters, minimizing the consumption of water and the production of wastewater.

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