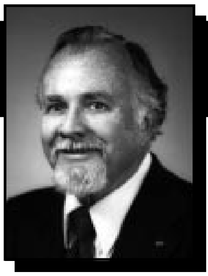

Pretreatment & Organic Finishing

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Water, Water Everywhere

"Water, water everywhere, but not a drop to drink" is the old mariner's dilemma. We people are a funny lot. We absorb vast amounts of knowledge from different sources and when we think we know it all, that's all we know. The more we know, the less we know we know. Fortunately, most of us eventually find that we are still learning and need to help each other find ways to keep learning. One thing we know is that the earth is covered by about 70–75 percent water.

Dilution and Pollution

Around 1960, the U.S. was using about 260 billion gal of water/day. By 1980, it was using more than 500 billion gal/day. There is a saying that "dilution is not the solution to pollution." With that dramatic increase in the use of water, it would seem that we were doing just that—using more to get rid of the chemicals, so it could flow to the oceans where there is plenty of room for dilution. Right? Wrong.

The expanded use of water has been caused by many reasons. One significant increase over the last 60 years is the result of the flush toilet. Every household in the U.S. uses an average of 13,000 gal of water each year to flush about 165 gal of sewage (human waste). It has been projected that we will be using more than 80 billion gal/day by the year 2000. That's enough water to cover a strip 100 ft wide and three ft deep from Richmond, VA to New York City.

Water is a weak electrolyte and is said to have a high dielectric constant (*e.g.*, good insulating properties). To conduct an electric current, water must dissociate into hydrogen and hydroxyl ions (H^+, OH^-). It does so to such a limited extent that it requires other salts or elements to increase the dissociation. The hydrogen bond to oxygen is not too strong, but because of the electron-sharing arrangement, one molecule of water will react with another until it forms a lattice arrangement of molecules of water sharing each other, similar to a bottle filled with different colored marbles.

What Makes An Efficient Rinse?

Is an efficient rinse one with good circulation of water with a lot of dilution, or one that uses water more efficiently? Or, is it one where water is recycled into the process, even with these lattices in the water combined with soils, such as oils, solids, soaps, and other things?

Some say it is how the water is introduced, or where it is introduced to the process—at the bottom of the tank, the center, or as the parts come out of the process chemical stage. You name it!

Rinse stages do have an effect on the performance of chemical baths, and affect the quality of the finished product. Ignoring this is asking for trouble. Keep in mind that in many process lines, rinses do not remove anything. They only dilute, because the rinsewater is recirculated or agitated.

Typically, an alkaline cleaner will build up in the succeeding rinse stage and eventually will be carried into the acidic iron or zinc phosphate bath. The alkali neutralizes the acid, chemical consumption increases in the bath, and the proper pH is nearly impossible to maintain, thereby affecting product quality. Similar problems arise when acidic iron phosphates are allowed to build in the final rinse stages. The residual phosphate acts as any other salt when allowed to dry on the finished surface.

These are just some of the reasons that the rinse must be titrated and controlled like any other chemical bath. Levels of chemical carryover, dissolved solids content, and pH values must be monitored and adjusted accordingly to prevent contamination of succeeding tanks and phosphate surfaces. Control parameter limits must be established and maintained rigorously. If a rinse exceeds the limits, it should be dumped or diluted with make-up water, according to specific operating permits from applicable regulatory authorities.

Efficient & Effective

Efficiency and cleanliness do not always go hand-in-hand in rinse stages. A clean rinse with insufficient physical impact or coverage of parts does not dilute effectively. Cleaner or soil films may cling in sufficient quantity to contaminate other baths, affecting the finished parts. Rinse solutions, just like phosphate solutions, need physical impact, contact and time. Spray patterns and pressures must be determined from monitoring the operation. A minimum of 30 sec is usually the starting point for rinsing. The shape, size, blind corners, ledges, tray-shelves, and side angle of the work should determine the volume of water applied with the rinse.

Two separate back-to-back rinse stages are best. If that isn't possible, add an arch of fresh water mist in the exit vestibule for the parts to pass through as they exit the line.

A counterflow rinse stage can improve rinsing efficiency by as much as 50 percent, and reduce water consumption by about the same. It also helps to treat and recycle rinsewater within the process. Some of the rinsewater can be used as make-up water in the chemical stages, if proper filtration is used to remove contamination in both the chemical solutions and rinse stages.

Consideration should be given to some type of product recovery in a planned process. Chemical solutions can be added to extend the life and efficiency of solutions.

A system where rinsewater is evaporated and concentrated, allowing it to be retuned to the process tanks, must be considered today. Always work toward recycling rinsewater after treatment, and continue to move toward the ultimate goal—zero discharge.

Next month will cover recycling rinsewaters, and final seals. o