What is the Best Way to Determine your Cleaning Costs?

The most effective and common cleaning chemistries utilize 2 methods of removing contaminants; emulsifying and displacement.

- With an emulsifying cleaner, oily soils are held or encapsulated at the operating temperature. When cooled, there may be some release of these oils.
- A displacement type cleaner literally displaces oils from the substrate surface.

Since most oily soils are less dense than water, they will float on the bath surface. With either cleaner, released oily soils can be removed by mechanical devices and filters. By regularly removing these soils, contaminants are also removed, minimizing their effect relative to aging the cleaner bath. Specifically, the service life of the cleaner is extended, resulting in genuine and repeatable cost savings. It's a win-win - maintaining a higher degree of cleaning efficiency while being a more economical alternative.

But does displacement cleaning offer an advantage to emulsifying cleaning or vice versa? Let's find out.

Three types of cleaners to work with: powder, liquid and additives.

1. Powder cleaners have been a staple of the industry for decades. They continue to be heavily used and offer a wide variety of dependable formulations, tackling all types of cleaning demands.
2. Liquid cleaners are formulated as equivalent to powders, though they also offer certain additional benefits such as:
    a. significantly less sludging (a plus when considering F-008 regulations and cost to ship sludge)
    b. easier and safer make up
        i. concentrate is assured of being 100% blended throughout
        ii. can be metered and continually analyzed by conductivity measurement (SPC and NADCAP benefits)
    c. for larger volume users, liquid cleaners may be supplied in returnable totes, eliminating the disposal of empty drums

3. Additives - in combination with generic liquid caustic soda (usually 50% strength) – are primarily used in the cleaning of steel.
    a. An additive concentrate (typically liquid) is added in specific ratio with liquid caustic soda in the soak cleaner, and a different ratio for both in the electrocleaner

Dual-functioning Cleaners

In some instances, there is reason to consider branching off the traditional stand-alone soak and electrocleaners and opt for a dual-functioning cleaner: A combination soak and electrocleaner in one tank, or in separate process tanks where a rinse in between can be eliminated.

Benefits include:

- Simplifying of inventory
- Omitting a rinse (and thereby conserving water)
- Doubling the function of a single process tank (saving on heating and maintenance)
- Use of generic liquid caustic soda reduces chemical costs overall.

Analytical Control

Analytical control as it applies to cleaning methodologies simply cannot be overemphasized.

The most common analysis has been the neutralization titration with standard acid solution to an indicator-induced solution color change. Frankly, it is hard to improve on this method, as most cleaners contain complex wetter and surfactant systems.

Complex analysis procedures (yes, multiple procedures) to analyze each wetter / surfactant component are extremely difficult to pull off. Even university chemistry staff, armed with specialized instruments and elegant techniques, would find them challenging. Beyond the cost of maintaining in-house staff and equipment, complexity is compounded in trying to accurately determine which wetter / surfactant to add, and how much.

Relatively speaking, the cost of cleaner is quite inexpensive and efficiently corrects for satisfactory cleaning results via the simple neutralization titration. Keep it simple and effective, relying with confidence on the neutralization titration.

The operation continues with cleaner-bath analysis by titration (or test kit), maintenance-adds, and rolling along until dump time.

Should the operator be required to dump the cleaner after a determined quantity of cleaner has already been added? This reminds us of the general schedule to dump after the maintenance additions are 2X the initial make-up quantity. Are we certain the cleaner bath is actually “shot?” What if it has 25% or some other viable percentage of service life left? This is where some simple, additional analysis can help in better determining the actual dump cycle.

Two suggestions:

1. Fill a graduate cylinder with the heated cleaner. Let it cool. Measure how much oil has split. Carefully track a new bath make-up. Note the oil displacement when the cleaner is dumped. Repeat for the next cleaner bath and keep operating past the oil split level for the previously dumped cleaner. Meanwhile, continuously analyze by titration for the product, making required additions. Coinciding with analysis, perform the oil split determination. You may find that the cleaner has been dumped too soon.

Displaced Oil Cleaner Test

2. Immerse a clean steel panel in a sample of the cleaner at operating temperature, time and concentration. Rinse and observe for any water breaks on the panel. If there are water breaks, add 10-20% of initial-make up to the sample. Repeat the cleaning step and water-break test on a new panel. If there's no water break, dip the rinsed panel in dilute acid (ex. 5% hydrochloric or sulfuric), then rinse again. If a water break is in evidence, repeat the suggested add of cleaner, and repeat the sequence of rinse and acid dip, followed by rinse. If these steps confirm no water breaks, the cleaner can be expected to continue production operation. The optional cleaner addition is made per results of the described test.

Water Break Condition Requires Addition of Cleaner

Bottom-line Results

Such analysis can be invaluable to ensuring satisfactory cleaning, equipping operators with additional useful data to better determine dump cycles. To recap, the ability to extend the bath-service life reduces costs in several significant ways: Beyond reducing downtime, consuming less cleaning product, and easing demand on waste-treatment systems, better ongoing cleaning results in less rejects that would have to be scrapped or re-worked.

Calculating Costs: A Practical equation

What follows is a method of calculating your operation's cleaning costs, which can be derived from the following equation:

$$C = S/PD + M/PD + R/P + W/PD$$

Key:

C = production standard. Ex: cost to clean 1,000 ft2 of parts.
S = the cost of chemicals, include make up and maintenance.
M = the cost of dumping a cleaner and replacing it with a new make-up.
R = the cost to re-work rejects or scrap parts.
W = the cost for waste treatment of the dumped cleaner.
P = daily production of parts in units (ft2, etc.…)
D = # of working days the cleaner is used in production during its service life.

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