Concentration Control of Washing Compounds

In the field of aqueous (water-based) parts cleaning, the control of working concentration is one of the cornerstones to good cleaning and extended bath life.

When talking about water-based parts cleaning systems, the variables are often expressed as TACT or the 4-Ts. These are acronyms for Time, Agitation, Concentration, and Temperature, or Time, Turbulence, Temperature, and Titration. Typically by increasing any one of these items it is possible to increase the efficiency of the cleaning system. So if washer capacity was the "constraint", by increasing the bath temperature, the concentration of the cleaning bath, and/or the amount of agitation, more parts per unit time could be put through the system. Concentration as with each of the other variables has upper and lower limits that are imposed by the design of the system, the material being cleaned, and/or cleaning compound in use.

When we look specifically at concentration, the lower limit is very often based on the amount of corrosion inhibition needed on the clean part. The upper limit is based on cost.

When trouble shooting a parts washing problem the first two items checked are temperature and concentration, as they are the variables that are the most frequent cause of cleaning problems.

If the washing compound concentration is too low we often find problems with:

1. The parts not getting clean
2. Corrosion on the parts or the washer
3. System odor

If the concentration is too high we often find problems with:

1. Residue
2. Staining
3. Excessive product usage
4. "Sludge" buildup in the washer
5. Dermatitis

There are many ways of checking concentration; however there are only three (3) that work on the shop floor and they are:

1. Concentration by alkaline titration
2. Concentration by conductivity
3. Concentration by refractive index

Alkaline titration is the preferred method for most products both in the laboratory and on the shop floor. It has the advantage that it accurately measures one of the key building blocks of most parts cleaners, its alkaline builders. There are many different kits or methods of doing these kinds of titrations. It is critically important that the method and factors specified for the particular product in use be used. While doing the titration itself is not difficult, operator technique is critical for consistent results. Read and follow the protocol recommended for your product.

Conductivity can also be used as a measure of concentration. Conductivity is a measure of the amount of electricity that will flow across a gap of a given size when the electrodes that form the gap are submerged in a fluid. (Mineral free water will not conduct electricity while salt water is a very good conductor.) As the % salt content goes up the ability of the fluid to conduct electricity does as well. Thus if we understand the relationship between the two it is possible to determine concentration by measuring conductivity.

This electrical method of checking concentration is particularly useful as it can be used to automate makeup to the washer. When the conductivity drops, the system calls for concentrate and adds until the desired concentration (conductivity) is achieved.

While measuring concentration by **refractive index** is possible on a theoretical basis, on a practical level it only works when the system is fresh charged (clean). When dirt gets mixed with the washing compound, it substantially changes the refractometer reading for the fluid. As a "rule of thumb" 1% oil will change the refractometer reading by 1 Brix degree.

In nearly all situations titration is the recommended method of checking concentration. Titration will yield the best and most useful information.