Alkaline Cleaning

In the typical metal finishing process, the alkaline cleaning tanks are first in line and take the bulk of the dirt load. Whether the tanks are soak cleaners, ultrasonic assisted cleaners, or electrocleaners, their purpose is to remove oils, grease, wax, polishing compound, particulates, and light oxides from the part surfaces. Depending on the detergent additives in these tanks, the tanks could build up surface oil, oil emulsions, suspended solids, or sludge at the bottom of the tank or any combination of these contaminants. As with acids, the cleaning chemicals are consumed in the process of removing and preventing redeposition of the contaminants.

Bath chemistry control
First, there should be a procedure in place to monitor the alkaline cleaning strength of a bath. It may be as simple as measuring the pH or as complicated as sending a sample out for chemical analysis. Typically the cleaning chemistry supplier can either do the testing or provide test kits or test methods to monitor and correct the cleaning chemistry as it ages.

Surface oils
The surface oils can be segregated and removed by a combination of surface sparging to a weir and the use of various oil skimmers available on the market to pull the accumulating oil from the weir. What needs to be avoided is “dead zones” on the tank surface where oils can accumulate and be redeposited as parts leave the tank. A well designed sparger will push a uniform layer of surface water across the tank and over the weir. This surface layer will contain a film of oil that can then be concentrated in the weir trough where it can be skimmed by various methods (belt skimmer, disk skimmer, concentrator vanes).

Photo of the sparger and weir system in a Grease Monkey Classic manufactured by Blackstone Ney
Note that normally the water level would be higher such that the sparger tube would be half submerged and water would be flowing over the weir. For photo clarity, the tank level was lowered to show the water jets from the sparger. If the system was actually operated this way there would be a chance of foaming.

**Particulate**
Third, the heavy particles that can settle on the bottom of the tank can be removed by bag filtration or some other simple filtration method. Removal of the heavy solids is especially important if the cleaning tank has ultrasonic transducers on the bottom of the tank. A layer of dirt covering the ultrasonic transducers will reduce the efficiency of the ultrasonic cleaning action. The filtration system needs to be sized for both the expected particulate size and particulate loading. Heavily soiled parts may require a dual filter system that can be switched as alternate side gets loaded allowing filter change-outs on the fly.

**Emulsions and suspended solids**
Finally, there are the emulsified oils and suspended solids. These are more difficult to remove by normal filtration methods. *Ultrafiltration* is a method that can often break the oil emulsions and remove the suspended solids without removing the active cleaning chemistry. The ultrafiltration type will depend on the pH of the cleaning chemistry and the bath temperature. Polymer filter types are quite capable of removing suspended solids and emulsified oils but cannot tolerate elevated temperatures or extremes of pH. Some of the commercially available polymer ultrafiltration systems can handle pH from 0 to 14 and temperatures up to 158°F (Koch Membrane Systems, SelRO®). One ultrafiltration system manufactured by Arbortech Corporation has filtration capability of a 1 to 14 pH range and temperature limits of over 200°F. Therefore, this system can easily filter hot alkaline cleaners without filter damage. For whatever ultrafiltration method used, the resulting filtered cleaning solution should provide minimal loss of the cleaning chemistry and maximum removal of the suspended solids and emulsified oils such that the cleaning chemistry is ready to use again.

Photo of a cleaner filtered by an Arbortech filtration unit.
Left, prefiltered sample, right, filtered sample
Centrifugation
Another method that may produce good results is centrifugation of the cleaning solution. There are many continuous centrifugation systems that will provide oil-water separation, water-solids separation, or both. The effectiveness of this method for oil emulsion removal will depend on the strength of the emulsion created by the cleaning chemistry. Some chemical emulsifiers are so strong that a typical centrifuge cannot break the emulsion.

Centrifugation can typically handle suspended solids (colloidal particles) but will still depend on particle size and centrifugal forces. Bench testing may still be necessary to confirm the process feasibility.