Membrane filtration is utilized to remove oil and suspended solids from alkaline cleaning baths used to clean a wide variety of steel and other metal parts. Cleaning chemical costs and energy costs are reduced significantly. The contaminants from the bath are concentrated and disposed at a fraction of the previous cost.

**System Design**

The treatment system design may vary depending upon the individual requirements. Where multiple small wash baths are used, a batch system can be set up to completely empty each wash tank and refill it from a reuse tank. In larger systems, the design will normally include continuous recirculation from the wash solution tank to the treatment system with clean solution being returned directly to the wash tank. Where free oil is present, the solution will first be passed through an oil/water separator.

**Membrane Selection**

Each different cleaning application may dictate the use of different generic types of membrane filters. Most commonly, they are either microfiltration (MF) or ultrafiltration (UF) membranes and normally of tubular configuration. Polymeric membranes may be limited to a maximum operating pH of 11 and maximum temperature of 150°F. Carbon and ceramic membranes can be used at higher temperatures and higher pH.

**Simple Mechanical Process**

The membrane filter is a mechanical system that allows clean water to pass the filter while contaminants are rejected and returned to the waste holding tank. There are no chemicals required. An oily concentrate is generated, which normally is disposed to a waste oil recovery company. The system simply separates the contaminants from the water, whereas a chemical treatment system generates copious amounts of sludge that must be dewatered and disposed of.

**Low Cost Recovery**

The membranes prevent anything larger than the pore size of the membrane to pass through. This means that oil and soil will be retained by the membrane and concentrated in the process tank, which forms part of the complete treatment system. After a period of time when the concentration of the contaminants has reached a high level; the tank is dumped, the contents disposed of as waste (or in the case of high oil content streams, may be recovered as a useful product) and the process tank is refilled with fresh waste fluid. The only cost of operation is the cost of power for the circulation pump.
Low Cost Recovery (cont’d)

In the case of alkaline cleaning fluids, some of the components of the fluid will emulsify oils and tie up small solids that are removed from the contaminated alkaline fluid. This is the material that is removed from the waste so that the recovered fluid can be reused. After treatment to remove oil and soil in the membrane systems, there are generally two ways of recalibrating the fluid for reuse. First, concentrate is added to bring the pH back to the original specification. Since much of the original builders of the cleaner are recovered in this manner, there may be a deficit of surfactant in the recovered mixture since oil and soil will have associated with the surfactant and have been removed by the membrane. Therefore, for full recovery, surfactant may also have to be added. This surfactant is not “lost”, in the sense that the membrane has removed active surfactant but could be considered “spent” and is no longer of use, having served its function in preventing free oil and solids from re-contaminating the parts being cleaned.

Unattended Operation

Since this process is completely mechanical and not dependent upon chemical feed and the coagulation and flocculation process, the only operational requirement is to clean the membrane filters periodically. This is a simple process that typically requires less than one half hour of an operator’s time. A chemical treatment system requires ongoing adjustments of the chemical feed pumps, makeup of the chemical feeds, operation of the dewatering system and control calibration and adjustment. The chemical system tasks require continual attention on a daily basis, whereas the membrane filtration system requires attention only for cleaning.

Consistent High Quality Water

The membrane filter forms a positive barrier to the flow of contaminants, producing continuous high quality fluid without operator attention. The membrane system is not affected by variability of the waste stream. The purified fluid is suitable for reuse or sewer discharge, assuming that pH adjustment is carried out where required.

Low Operating Cost

The only costs associated with a membrane system are the cost of electricity to power the recirculation pump and the periodic (infrequent) cost of membrane replacement, and a small additional cost for cleaning chemicals to periodically clean the membranes. The life of the membranes is a function of several factors but is always measured in years.

Summary of Benefits

- Simple mechanical process
- Consistent high quality water
- Ability to reuse purified water
- Low operating costs.
- Unattended operation
- Minimal disposal cost

Equipment Shown:

Picture illustrates a small (500-1000 gallons per day) system, typically used for alkaline cleaner regeneration and recovery.