

# WasteWizard® Application Review: Synthetic Machine Coolant Recycling

## Customers Who Benefit From This Recycle Technology

Small, medium, and large machine shops in the Primary Metal Industries, Fabricated Metal Products, Industrial & Commercial Machinery and Transportation Equipment Manufacturing.

## Waste Water Source

**Water Soluble/Semi-synthetic Coolants:** Used in the machining of all types of metals. "Water soluble" coolants are so-named because they are chemically formulated with surfactants to "solubilize" the oils into an emulsion. Semi-synthetic coolants utilize both "solubilized" oils and synthetic chemicals to accomplish the same purpose. Both of these types of coolants are emulsions and therefore when they become "spent", the oil can be removed from the water and surfactants by ultrafiltration. These coolants can be reused for a period of time but not recycled indefinitely. Crude filtration systems with pasteurization do exist to increase the longevity of the coolant. These solutions become spent due to contamination by "tramp" oils and by attack upon the oils from bacteria. Ultimately, the solution becomes rancid and loses its lubricity.

**Synthetic Coolants:** In recent years coolant companies have been promoting the so-called "true synthetic" coolants. The formulation of these products varies widely. By definition, however, they do not utilize oils in the formulation and therefore are not emulsions. Synthetic coolants are marketed on the basis that they will last virtually forever because they have no oils for the bacteria to attack. In practice, this works to a point, since the coolants get contaminated with solids and free oils. When this contamination occurs, filtering can help to recycle the coolant.

## Waste Water Description

The waste water from this source is typically between 2% and 4% emulsified oil (water soluble/semi-synthetic) in the feed. In addition, it can be contaminated with significant "tramp" oils if the machine shop has old machines with leaking hydraulic systems. The amount of solids in this application can vary widely. Grinding applications will generate more than most other applications and will require good pre-filtration.

## Objective of Treatment System

Recycle: For water soluble (synthetics), permeate is typically of satisfactory quality to recycle with new coolant make-up, however, it will build up hardness with time and may have to be purged occasionally to comply with the water quality requirements of the coolant manufacturers.

## Features and Benefits

<i>Ransohoff Features</i>	<i>Ransohoff Benefits</i>
<b>Hydrophilic Membrane</b>	Eliminates cost for free oil removal pre-treatment
<b>Membrane Resists Oil Fouling</b>	High /stable output during the run and throughout the life of the membrane
<b>Solvent Resistant Membrane</b>	Reliable operation in a stream that can contain tapping fluids or other organic solvents used in the machine shop
<b>Automated Cleaning</b>	No labor required which can offset savings
<b>Portable System</b>	Can operate off 55-gallon drums in multiple plant locations
<b>Limited Hauling</b>	Control of your own destiny since having a waste generator retains liability Lower cost of processing: ~\$0.01 - \$0.10/gallon (\$0.0024 to \$0.024/liter) vs. \$0.30-\$3.00/gallon (\$0.08-\$0.8/liter) to haul, plus the additional cost of new coolant

## Overall System Design

<i>UF Process Parameters</i>	
<b>Temperature of Operation</b>	Ambient (70-80°F) (23 -27°C)
<b>Expected Flux Rate</b>	30 gsf/d (very conservative, will likely be higher)
<b>Volume of Permeate</b>	90-95% (based on 2-4% oil)
<b>Volume of Concentrate</b>	5-10%
<b>Membrane of Choice</b>	Ultrafilic MX-500 (500,000mwco) for synthetic recycle.

**Recommended Process Flow Schematic:** Ransohoff has developed an overall flow schematic that is the recommended way to set the systems up in the customer's plant. We offer accessory packages that can be purchased to assemble the system as recommended or the customer can choose to assemble these accessories themselves.

### Pre-Treatment

**Holding Tank:** A tank provided to handle surges in flow from the plant as machine sumps are emptied. The general rule of thumb is to size the tank around one day's processing volume (i.e., 200 gallon (760 l) tank for WW-2). However, sizing of this tank is not critical to the operation of the UF system.

**Working Tank:** The minimum tankage required to operate the system is a working tank. This tank can be sized at about ½ the day's processing volume. Sizing of this tank will affect the performance of the system: the larger the tank, the better the performance of the system over a longer period of time. The tank size can be compromised only for applications where low solids, low oil and/or short run times are acceptable.

### Pre-Filtration

**High Solids:** For high solids operation, settling may be necessary and require the use of a conical bottom holding tank.

**Low Solids:** For low solids operations, pre-filtration in the working tank is recommended. Use Ransohoff's prefiltration accessories to achieve this prefiltration in an automated system.

### Free Oil Removal

The use of a skimmer in the holding tank or a coalescer in the feed line can be incorporated if the free oil content is exceptionally high and a long run time between cleaning is required.

### Economic Considerations

The driving force for installing a treatment system for the small to medium size plant is economics of treatment vs. hauling. The cost of hauling can run from \$0.30/gallon to \$3.00/gallon (\$0.08-\$0.80/liter). The amount the customer is paying will depend on his location (regional laws and plant proximity to hauling company) and the amount the customer is hauling. Cost per gallon can be deceiving since many of the small waste generators will get charged a flat pickup charge or a drum surcharge in addition to the price per gallon. The following calculation can be used to "qualify" a customer at a given hauling rate.

**When calculating the savings, the salesperson or engineer should include the following factors.**

Annual cost of waste hauling today

Less:

- Depreciation on Ransohoff system per year (the cost of the system divided by 7 years).
- Annual cost of prefilters (estimate based on solids loading: typically \$100 - \$300 per year)
- Annual cost of operating labor (the WW system will not likely require incremental labor over that presently being used in the shop)
- Annual power consumption for system operation. (Will depend on size of system.)

Equals:

- Total Annual Savings.

### Competition

Company	Technology	Advantages	Disadvantages
KOCH	Tubular	<ul style="list-style-type: none"> <li>• High solids capability</li> <li>• Long membrane life</li> <li>• Large installed base of custom system</li> </ul>	<ul style="list-style-type: none"> <li>• Large space requirement</li> <li>• Large pumping requirement</li> <li>• Not focused on small end user</li> <li>• No interest in total solution for small end user</li> <li>• High capital expense PVDF membrane fouls with free oil</li> </ul>
	Hollow Fiber	<ul style="list-style-type: none"> <li>• Large membrane in small footprint</li> <li>• Good distribution network</li> <li>• User-friendly pre-package system from 50gpd to 4000gpd</li> </ul>	<ul style="list-style-type: none"> <li>• Fragile membrane</li> <li>• Membrane will fail with any solvent exposure</li> <li>• Manual cleaning creates unreliable performance</li> <li>• Temperature limit 113</li> <li>• Acrylic co-polymer fouls with free oil</li> </ul>
SANBORN	Tubular	<ul style="list-style-type: none"> <li>• Generally same as Koch tubes</li> <li>• Will sell complete systems including centrifuges</li> </ul>	<ul style="list-style-type: none"> <li>• Generally same as Koch tubes</li> <li>• Buys membrane from Nitto Danko</li> <li>• Reputation in market for selling systems that don't work</li> </ul>