NEW LOGIC RESEARCH, INC.

APPLICATION NOTE

V✧SEP Membrane Filtration of Wine Barrel Rinse Water

An environmentally friendly treatment solution

Over 8000 years old, the wine making process has undergone a surprisingly small number of changes during the course of its long history. This perfected art, however, has recently begun evolving due to the ever-increasing environmental and sustainability concerns that have arisen during the last decade. While many wineries around the world are doing their part to "go green," one large winery in Sonoma County, California is the first worldwide to employ the V✧SEP barrel rinse water treatment system in order to save water and reduce their carbon footprint.

Developed by New Logic Research, the Vibratory Shear Enhanced Process (V✧SEP) uses a vibrating membrane mechanism to avoid fouling and allow for a precise liquid-solid separation in just one pass. Using V✧SEP, wineries are now able to recover reusable, clean water from wine barrel rinse water while concentrating and volume reducing the lees for further treatment.

Background Information

Conventional Treatment of Wine Lees

Wine lees consist of dead yeast cells, grape skins, seeds, pulp, and stems along with other organic material that separate from the juice during the winemaking process. Lees are occasionally used to enhance the wine's flavor, especially in white wines like Chardonnay, but are disposed of once the juice is racked. The barrels with the residual wine and wine lees are rinsed out before the next batch. This rinse water, high in organic content, is often treated with a digester then discharged to the sewer.

With recent concerns about the health of the natural environment, there has been increasing pressure on companies to adopt sustainable business practices, namely to produce a valued product without diminishing natural resources or harming the environment. Because of this, unnecessarily discharging large quantities of reusable water and useful organics is looked upon negatively by the consumer. Fortunately, this problem is easily remedied with V✧SEP.

Membranes

Membrane separation technology has been a reliable filtration method for many years. Initially, the use of membranes was isolated to a laboratory scale. However, improvements over the past twenty years have allowed for the industrial use of membranes. A membrane is simply a synthetic barrier, which prevents the transport of certain components based on various characteristics.

All membranes separate in some form, but can differ widely in terms of their makeup, pore size, and separation type. Membranes can be liquid or solid, homogeneous or heterogeneous and can vary in thickness. They can be manufactured to be electrically neutral, positive, negative or bipolar. These different characteristics enable membranes to perform many different separations from reverse osmosis to micro-filtration. The four main categories of membrane filtration, Reverse Osmosis, Nanofiltration, Ultrafiltration and Microfiltration, are determined by either the membrane's pore size or the molecular weight cut off.

Reverse Osmosis Membranes
Reverse Osmosis membranes are the tightest of the four categories. They are generally rated on the % of salts that they can remove from a feed stream. However, they can also be specified by Molecular Weight cutoff. Usually, the rejection of NaCl will be greater than 95% in order to be classed as an RO membrane. These membranes are commonly used in the desalination of seawater and they are also used to remove color, fragrance and flavor from water streams. Because of its unique technology, V✧SEP is able to utilize these RO membranes to treat hundreds of high solids streams that most RO membrane systems can't touch. Landfill leachate, produced water, hog manure, and RO reject are just a few examples. Reverse Osmosis membranes don't have structural pores. Filtration occurs as ionic species are able to diffuse their way through the membrane itself (hence the name: *reverse* osmosis).

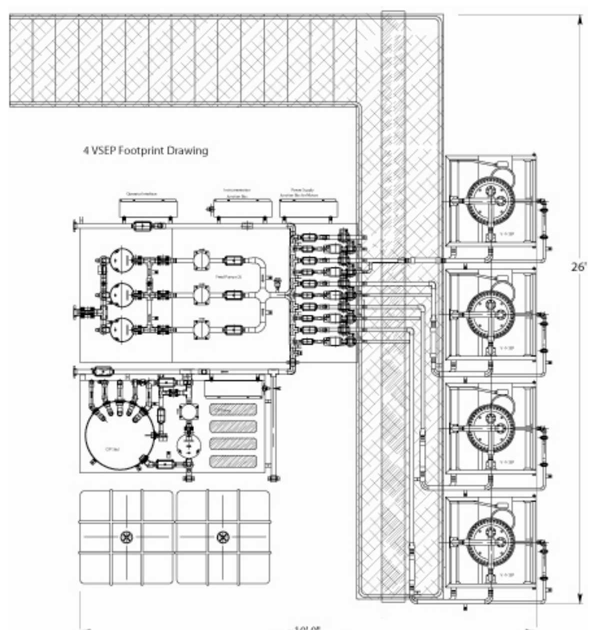
Nanofiltration Membranes
A great deal of recent research has led to the improvement of membranes in the range of Nanofiltration. As the name suggests, these membranes are used to separate materials on the order of nanometers. These membranes are not usually rated based on their pore size because the pores are very small and difficult to measure accurately. Instead they are rated based on the approximate molecular weight of the components that they reject or the % of salts that they can remove from a stream. These membranes are used predominately for wastewater treatment but they are also used to concentrate material that has a wide range of particle sizes.

Ultrafiltration Membranes
Conventional Ultrafiltration membranes are composed of some type of polymer material with pores ranging from a little less than 0.01 µm to 0.1 µm. These membranes are used for many different separations including oily wastewater treatment, protein concentration, colloidal silica concentration, and for the treatment of various wastewaters in the Pulp & Paper industry.

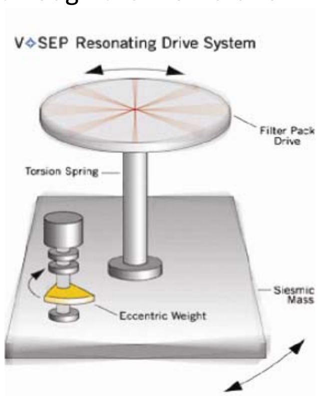
Microfiltration Membranes
These membranes tend to be porous, with pores greater than 0.1µm and are used to separate larger particulate matter from a liquid phase. Some examples would be coarse minerals or paint particles, which need to be concentrated from an aqueous solution.

The V✧SEP Advantage

The V✧SEP membrane system is a vertical plate and frame type of construction where membrane leafs are stacked by the hundreds on top of each other. Because the membranes are stacked vertically, the horizontal footprint of the unit is very small. As much as 2000 square feet (185 m2) of membrane is contained in one V✧SEP module with a footprint of only 4' x 4'.



V✧SEP's vibratory shear enhanced process employs torsional vibration of the membrane surface, which creates high shear energy at the surface of the membrane. The result is that colloidal fouling and polarization of the membrane due to concentration of rejected materials are greatly reduced. Since colloidal fouling is avoided due to the vibration, the use of pretreatment to prevent scale formation is not required. In addition, the throughput rates of V✧SEP are 5-15 times higher in terms of GFD (gallons per square foot per day) when compared to other types of membrane systems. The sinusoidal shear waves propagating from the membrane surface act to hold suspended particles above the membrane surface allowing free transport of the liquid media through the membrane.



An eccentric weight induces a wobble that resonates at about 50 Hz giving vibration to the Filter Pack above

Conventional membranes are subject to colloidal fouling as suspended matter can become attached to the membrane surface and obstruct filtration. Crossflow is used to reduce the effects of this accumulation. Just as conventional membranes have limits on TDS due to the solubility limits of the various constituents, they also have limits on TSS, as colloidal fouling will occur if these levels are too high.

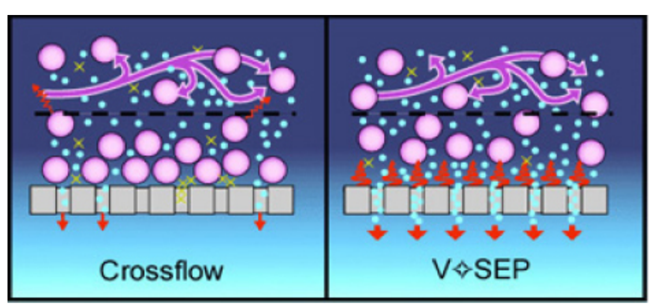
V✧SEP's torsional oscillation at a rate of 50 Hz at the membrane surface inhibits diffusion polarization of suspended colloids. This is a very effective method of colloid repulsion as sinusoidal shear waves from the membrane surface help to repel oncoming particles. The result is that suspended solids are held in suspension hovering above the membrane as a parallel layer where they can be washed away by tangential crossflow. This washing away process occurs at equilibrium.

Pressure and filtration rate will determine the thickness and mass of the suspended layer. Particles

of suspended colloids will be washed away by crossflow and at the same time new particles will arrive. The removal and arrival rate will be different at first until parity is reached and a state of equilibrium is reached with respect to the diffusion layer (also known as a boundary layer).

This layer is permeable and is not attached to the membrane; it is actually suspended above it. If too many of the scale colloids are formed, more will be removed to maintain the equilibrium of the diffusion layer. Because of this, V✧SEP is not limited when it comes to TSS concentrations as conventional membrane systems are.

Conventional membrane systems tend to develop cakes of colloids that would grow large enough to completely blind the conventional membrane. In V✧SEP, no matter how many arriving colloids there are, an equal number are removed as the diffusion layer is limited in size and cannot grow large enough to blind the system. In fact V✧SEP is capable of filtration of any liquid solution as long as it remains a liquid.



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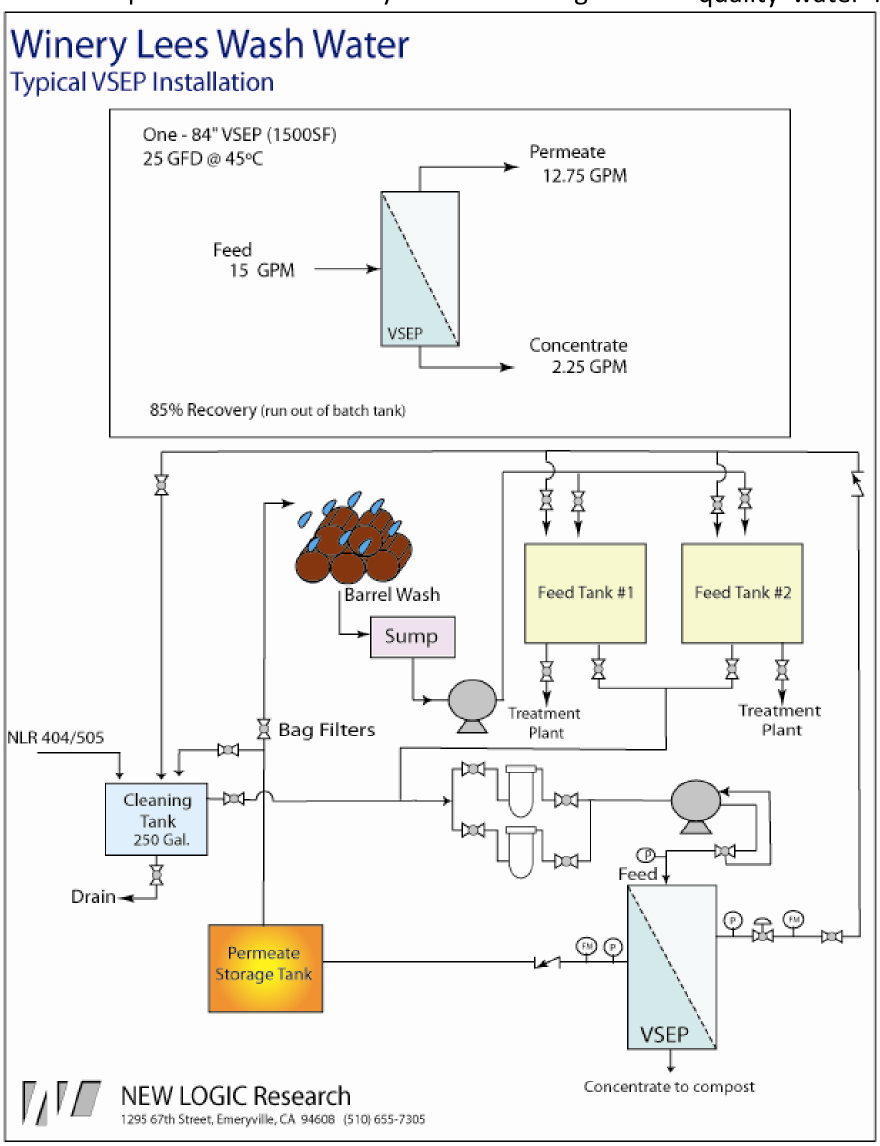
Wine Barrel Rinse Water Filtration with V✧SEP

Extensive pilot testing was performed with the V✧SEP system at the winery site in Sonoma County, California. The results from this testing proved V✧SEP to be the ideal solution for the treatment of water otherwise fit only for discharge. The clients goals were to obtain a high quality permeate (clean water) with low BOD and to concentrate wine lees slurry.

Using ESPA Reverse Osmosis membrane and operating in "batch" mode, V✧SEP was able to recover up to 90% of the clean water with no chemical pretreatment of any kind. The high quality water recovered by V✧SEP is fit for reuse while the concentrated wine lees can also be recycled, thus virtually eliminating superfluous liquid discharge.



Recognized by multiple environmental protection organizations including the EPA, this winemaker estimates savings of over 6 million gallons of water per year thanks to their sustainable practices. They are able to recover 90% of their water that is then reused in the rinsing process up to 10 times. In addition to water cost savings, the company saves heating cost since the recycled water retains up to 75% of its original heat during the filtration process. Truly environmentally friendly, this company composts the concentrated wine lees and other organics and uses this material as a natural fertilizer for their vineyards.

In addition, has a very small footprint especially compared to a disgester, the conventional treatment method for wine lees. Using the space-saving VGSEP system leaves the winemakers more precious grape-growing land.

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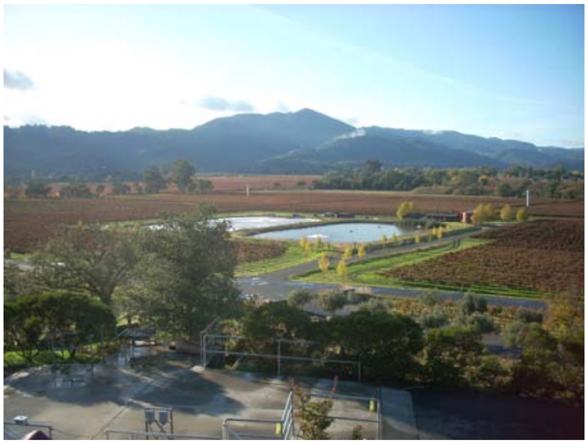

Digesters take up valuable grape-growing land at a Napa Valley Winery

With the limited water available in drought-ridden California, water conservation and reuse is capital. Of course, by implementing these "green" water saving technologies, this company has renewed its commitment to support sustainable business practices, a characteristic consumers have come to value. Now more than ever, consumers are supporting environmentally responsible companies. "Going green," especially in this environmentally conscientious day and age, is critical for the future survival of any winemaker.

Summary

New Logic Research has supplied V✧SEP separation technology successfully into many industrial processes. Helping the wine industry go green by recovering reusable water and lees is just one of the V✧SEP's many applications. The only membrane filtration system enhanced with "Vibratory Shear Enhanced Processing," VSEP consistently produces a precise liquid-solid separation in one pass.

Contact a New Logic representative to develop an economic analysis and justification for your next V✧SEP system.

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