

## Membrane Filtration of Fermentation Tank Bottoms

VSEP, An effective and economical solution for recovery of Beer from Beer Bottoms

New Logic Research manufactures a proprietary vibrating membrane filtration system known as VSEP that is uniquely designed for filtration of beer, wine, and other beverages. The use of a VSEP vibrating membrane mechanism allows for low energy gentle filtration and clarification to remove even sub-micron sized particles. New Logic has completed several beverage application installations using this vibrating membrane system and has developed a food grade design for this market. This new membrane system is known as VSEP which is an acronym for Vibratory Shear Enhanced Process and is manufactured by New Logic Research at its factory in Emeryville California near San Francisco.

Conventional methods of separation include filter presses, centrifugation, and conventional crossflow. All of these methods are high energy/high shearing devices that can disrupt the yeast cells and alter the taste and characteristics of the recovered beer. Typically 3-5% of the beer volume is retained in the bottoms of the fermentation tank. Recovery of this product while maintaining the taste characteristics would increase the yield of each batch.

### VSEP Advantages

VSEP employs torsional vibration of the membrane surface, which repels solids 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. In addition, the



throughput rates of VSEP 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 through the membrane

while solids are left behind and are concentrated.

The VSEP membrane system is a vertical plate and frame type of construction where membrane leafs are stacked by the hundreds on top of each other. The result of this is that the horizontal footprint of the unit is very small. As much as 2000 square feet (185 m<sup>2</sup>) of membrane is contained in one VSEP module with a footprint of only 16 Sq Ft (1.5 m<sup>2</sup>).

Conventional membranes are subject to fouling as suspended matter can become attached to the membrane surface and obstruct filtration. In some cases, these rejected solids form a boundary layer that does the actual filtration. With two filtration layers in series, flux rates are very low. Crossflow is used to reduce the effects of this accumulation. VSEP oscillation at the membrane surface inhibits 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.

### **Process Conditions**

VSEP filtration occurs as the membrane discs move in oscillation at a frequency of 50 times per second. Because the membrane is moving quickly, the fluid material to be filtered can be moved slowly and gently at low pressure to keep its integrity intact. The oscillation of the membrane keep the membrane from becoming fouled with rejected solids and allow for high filtration rates meaning quick in

and out handling of the beer and the yeast. The concentrated yeast material can be further processed and sold as animal feed.



A typical 84" VSEP module with 1300 square feet of membrane is capable of processing about 20 gpm (4.5 m<sup>3</sup>/hr). These modules can be used in parallel to process any flow rate needed. Using a microfiltration membrane, virtually all suspended solids are removed. Membrane materials include Teflon, PVDF, and Polyethersulfone. The typical pore size is about 0.05 microns. The VSEP system automatically processes the liquid based on tank level and provides a precise separation to high concentration levels with little or no operator involvement. Filtration can occur at cool temperatures to maintain product quality and can occur with an overlay of CO<sub>2</sub> gas blanket to maintain carbonation levels. Typical operating pressure is about 50 psi (350 kPa).

Chemical cleaning is done periodically and also when the system would be shut down at the end of production or at the end of a shift for proper sterilization. Simple caustic soda and clean water is used for this purpose. After cleaning a hot water flush is performed to leave the system ready for operation. All VSEP components are heat sanitizable.

### **Compact Design**

The VSEP Machine incorporates a modular design which makes it compact. Because the basic design is vertical rather than horizontal, the needed floor space per unit is inherently less than other types of separations systems. The VSEP does require up to 17' in ceiling clearance. In most industrial applications ceiling clearance is ample, it is floor space, which is limited. VSEP also comes in other sizes where the height limit is lower.

Benefits of VSEP Compact Design:

- Easily added into an existing process
- Can be installed where space is a premium
- Is portable and can be moved
- Can be expanded easily as demand grows

### **Economic Value**

New Logic's VSEP system provides an alternative approach for beverage clarification applications. In a single operation step, VSEP will provide ultra-pure filtrate free of harmful microorganisms. The justification for the use of VSEP treatment system in your process is determined through analysis of the system cost and benefits including:

- Large floor space not required
- Filtrate quality better than existing



- Fewer taste complaints.
- Elimination of harmful microorganisms
- Simple automated treatment system
- Little operator involvement
- No Chemical addition

Your New Logic Sales engineer can assist with economics analysis for your project and can demonstrate operating cost savings and Return on Investment calculations.

### **Summary**

New Logic Research has supplied VSEP separation technology successfully into many beverage processes including filtration of coffee extract, tea extract, orange juice, and drink mix products. Contact a New Logic representative to develop an economic analysis and justification for the VSEP in your system. For additional information and potential application of this technology to your process, please visit New Logic's VSEP Website at <http://www.vsep.com> or contact New Logic Research.

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