



Food and Beverage



Keraflux[®]-TFF System for yeast management



Keraflux-TFF System

for yeast management

The increasing cost of raw materials and energy are forcing the brewing industry to investigate new opportunities for increasing extract yield without compromising quality. Excess yeast contains a significant amount of extract which can be recovered by concentrating the yeast with modern cross flow technology. By combining this technology with controlled diafiltration the yield can even be boosted. The recovered beer can be blended to the original beer up to a level of 5 % volume without negatively influencing the taste. Thus, beer recovery can make a big contribution to cost savings in the brewery.

Benefits

- Cost reduction can include
 - Very short return on investment (ROI) of about 1 year
 - Net revenue > 90 % of the invested capital per year
 - High mechanical, thermal and chemical resistance of membranes for longer module lifetime
 - Easy installation due to modular concept
 - High system availability
 - Dry matter up to 20 % for high yield
 - Low maintenance cost
 - Low operating expense (OPEX)
 - High quality yeast for sale
- Excellent beer quality
 - Minimal difference between original beer and blended beer in terms of sensory and analytics
 - Closed system for minimum oxygen uptake
 - Clear cut off with low turbidity and almost yeast free beer
- High microbiological safety due to easy cleaning and sterilization with hot water up to 90 °C (194 °F)
- Easy to extend due to modular concept
- High yield, long module lifetime, consistent beer quality and reduced energy consumption due to controlled process

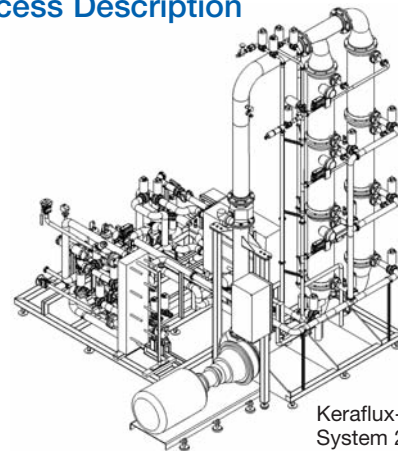
Cost Reduction by Process Control

The process for yeast extract recovery uses a ceramic cross flow technology with specific control features to achieve reduced costs.

- Cost savings
 - low consumption of cleaning agents and water
 - high system availability and production time
- Long production cycles and less cleaning cycles
 - Control of feed flow
 - Control of cross flow velocity
 - Control of permeate flow and trans membrane pressure (TMP) at each module level against target set points

Continuous adjustment of the process parameters to variable set points minimize energy consumption and provide gentle treatment of the yeast during the entire process. Most important is the control of permeate flux and TMP in direct relation to the cross flow speed and feed rate.

Process Description



Keraflux-TFF
System 2 x 3

The beer recovery is conducted in a batch process, which offers several advantages:

- Improved performance (up to 20 %) and quality due to lower yeast concentration in system during batch cycle
- Reduced energy consumption (up to 25 %) due to lower yeast concentration in system during batch cycle
- Yield up to 80 % due to diafiltration

Diafiltration Principle

In this special process developed by Pall, water is added to the yeast suspension to increase the extract and alcohol recovery (wash out effect) without compromising the beer quality.



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Filter Media

Membralox® Ceramic Membranes

- High flux
- Proven long operational life
- Excellent resistance to corrosion
- Wide chemical and pH (0 - 14) compatibility
- Excellent thermal stability
- Can be sanitized and sterilized

Membralox Modules

- High performance housing design and sealing assembly
- Membralox SD and HCB modules

Analytical Results and Taste Panel Data

To evaluate the percentage of beer which can be blended back to production without compromising the beer quality, several test were conducted. By chemical and sensory analysis carried out by independent institutes, it was shown that a back blending ratio of up to 5 % volume is suitable. The superior quality of the recovered and blended beers has been confirmed as follows:

- No identification of blended beers by taste panel
- Minimum deviation (within analytical method sensitivity) by basic analytics
- No significant differences on esters
- No significant differences on short chain fatty acids
- No significant difference in stale flavor active substances

Commercial Aspects

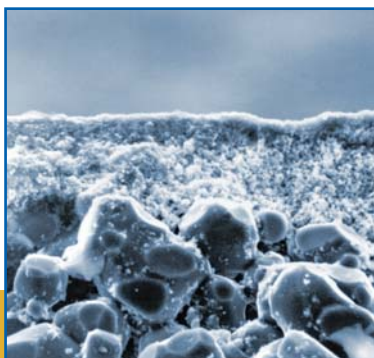
The short ROI with a range between 1 - 2 years make this technology and the investment made into it very attractive to the brewing industry.

Example

	Brewery A	Brewery B
Beer output (12° Plato)*	4,000,000 hl/a	2,000,000 hl/a
Brew house output (16° Plato)*	3,000,000 hl/a	1,500,000 hl/a
Yeast amount (16° Plato, 3 % of brew house output)*	90,000 hl/a	45,000 hl/a
Recovered beer (~ 80 % yield; 10.5° Plato)	110,000 hl/a	50,000 hl/a
Beer production cost (at 10 €/hl)*	1,100,000 €	500,000 €
Investment for system*	500,000 €	400,000 €
Investment for periphery*	500,000 €	500,000 €
OPEX* / hl	0.33 €	0.40 €
OPEX / annum	36,300 €	20,000 €
Costs (CAPEX + OPEX)	1,036,300 €	920,000 €
Gain / annum	1,100,000 €	500,000 €

Return on investment 1 - 2 years

*estimation



Cross section of Membralox ceramic membrane (x1010)



Membralox ceramic membranes



Membralox ceramic modules



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Technical data

		Keraflux-TFF System						
Module lines x modules high		2 x 2 SD	2 x 3 SD	2 x 2 HCB	2 x 3 HCB	3 x 2 HCB	3 x 3 HCB	3 x 4 HCB
Brewery size ¹ [hl/a]		2,000,000	3,300,000	3,300,000	4,800,000	4,800,000	7,300,000	9,700,000
Yeast amount ² [hl/day]		190	310	310	460	460	700	930
Footprint filtration unit [m]	Length	4.50	4.50	4.50	4.50	5.50	5.50	5.50
	Width	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Height	4.50	5.50	4.50	5.50	4.50	5.50	6.70
Footprint service unit [m]	Length	2.55	2.55	2.55	2.55	2.55	2.55	2.55
	Width	2.25	2.25	2.25	2.25	2.25	2.25	2.25
	Height	2.00	2.00	2.00	2.00	2.00	2.00	2.00

¹ 12° Plato

² Yeast amount: 3 % of beer volume (12 ° Plato)
15 ° Plato
250 working days per year
21 h filtration per day



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