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World Brewing Congress 2016

Management of Surplus Yeast in Modern Breweries

(Alexander Gertsman/Flottweg)

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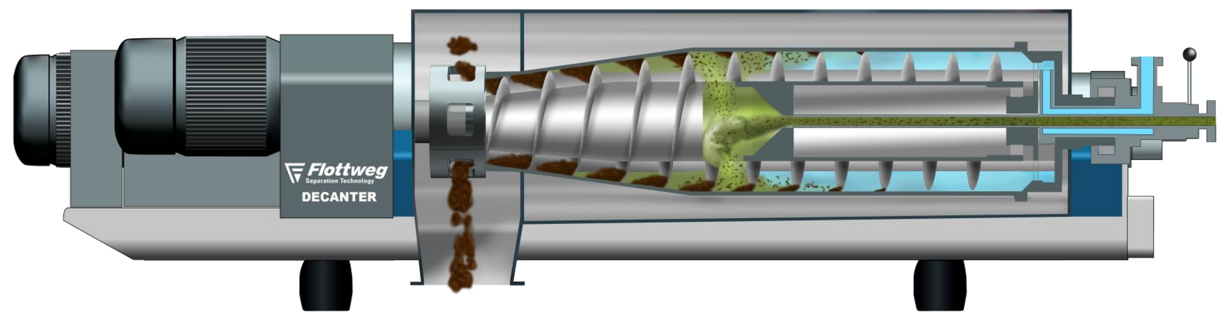
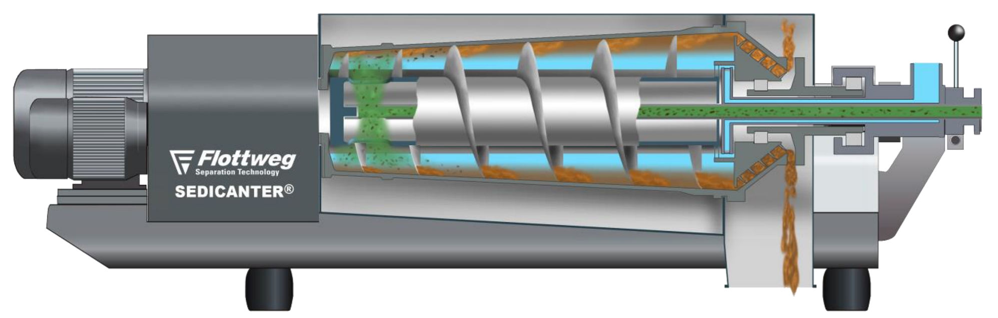
OVERVIEW

Management of surplus yeast is one of the most challenging and important tasks in the medium to large size breweries. While some breweries are working on just simply concentration of the spent yeast stream to meet the demand of facilities that buy it, some are also recovering beer that can be put back into the process. Buyers of brewers' surplus yeast are food producers (soup preparation, makers of vegemite), animal nutrition producers, farmers. Typical target concentration of the product is 20% w/w, as this is maximum value for which it remains in the liquid form. If the spent yeast is relatively fresh, beer recovered from it by mechanical separation is typically transferred to green beer process. Special measures of precaution must be taken to enable for the successful beer recovery, such as minimizing dissolved oxygen pick-up, storage and sanitation. For those who just want to process spent yeast as waste, still need to consider concentration of the stream in order not to overload the wastewater system in the brewery. Mechanical separation has been a method of choice for surplus yeast concentration, comprising of three methods: centrifugation, membrane filtration, pressure leaf filters and rotary vacuum drum filtration. The last two are less common to be found for new project consideration due to their inefficiency and desire to get away from diatomaceous earth usage. Membrane filtration methods consist of crossflow technology and less common vibrating membrane filters. The crossflow systems more commonly contain ceramic membranes, but sometimes polymeric types can also be encountered. While the membrane systems offer the best results when it comes to beer clarity, essentially 0% v/v solids, their shortcomings include high energy costs, high operating and maintenance costs, high consumption of water and cleaning solutions for CIP and substantial cooling requirements. Centrifugation can be done with automatic discharge disc separator, disc nozzle separator and a Sedicanter® (registered trademark of Flottweg Separation Technology). Centrifuging with an automatic disc separator can only be effective if the inlet concentration is quite low due to limitation in a sludge space and discontinuous type of solids ejection. Very frequent solids ejections lead to quick wear of the machine. Oversizing machine for strictly sludge pace is a costly solution and also subject of potential dissolved oxygen pick-up, issue of consideration when beer recovery is desired. Nozzle disc separator offers continuous concentrated yeast discharge and is a better solution compared to automatic type, but has deficiencies in terms of wetter solids production and also being prone to clogging, since nozzle diameter is quite small, sometimes less than a millimeter. Sedicanter® has ability to deliver the highest solids dryness, up to 28% w/w of dry matter, while maintaining same recovered beer quality as other centrifuges. High dry matter directly results in higher yield of beer.

Decanter - Sedicanter





The easiest way to understand the Sedicanter is to compare it to a typical decanter. A conventional decanter operates at approx. 4000 x G force to separate the yeast from beer. The yeast is packed tightly against the wall of the cylindrical rotor, and is then discharged via a "dry zone" in the bowl out of the decanter with the use of scroll that operates at different speed than the bowl. In contrast, the Sedicanter operates at speeds up to 10,000 x G, where the soft solids like yeast actually slide down into the high compression area, rather than being scrolled. The compression is largely accomplished by a hydraulic force at the deepest radius of the bowl. Afterword, the dry solids are discharged out of the Sedicanter by a tightly pitched scroll. In both cases, the clarified beer is discharged out of the bowl via centripetal pump, but the Sedicanter achieves much higher clarity. Cake dryness is also much higher in the Sedicanter.

Parameter	Decanter (Z4E)	Sedicanter (S4E)
Feed rate (hl/h)	10 – 12	20 - 30
Cake solids (% by wt)	20 – 22	24 - 28
Suspended solids in recovered beer (% v/v)	0.5 – 1.0	0.1 – 0.3
Oxygen pickup (ppm)	1 – 2	<0.5
Installed power (kW)	22	30
Feed solids (% by wt)	8 – 16	8 - 16

Disc stack centrifuge - Sedicanter

Compared to disc stack centrifuges, the Sedicanter also offers a better performance for beer recovery from yeast. The performance of the disc stack centrifuge is limited in case of high solids content in the feed. In a nozzle type disc stack centrifuge, discharged solids can only be in the flowing form, so the yield is really limited as it is impossible to produce dry cake. In automatic discharge centrifuge, solids can be more concentrated, but still fall significantly short of the cake solids produced by Sedicanter. Automatic disc stack separators are more limited in feed solids and can not operate in a fully continuous mode. Nozzle separator is prone to clogging if aiming for higher yield, while encountering feed solids variations. None of these issues are encountered with Sedicanter. Even with high feed solids concentrations, dilution is not needed for Sedicanter and the operation is always fully continuous at highest yields.

Parameter	Disc stack centrifuge	Sedicanter (S4E)
Feed rate (hl/h)	15 – 20	20 - 30
Feed solids (% by wt)	8 – 10	8 - 16
Cake solids (% by wt)	up to 20	24 - 28
Suspended solids in recovered beer (% v/v)	0.1 – 0.2	0.1 – 0.3
Cooling required	yes	no
Installed power (kW)	80	30
Maintenance costs as % of investment	5 p.a.	2 p.a.
Noise level	high (shot)	low

Cross Flow Filtration - Sedicanter

Ceramic cross flow membrane systems have exhibited some important process advantages compared to traditional techniques, such as filter presses, decanter and disc stack centrifuges, particularly in terms of recovered beer quality. Based on the comparison of process parameters listed below, Sedicanter is still a technically and economically viable alternative process to cross flow filtration.

Parameter	Cross Flow Filtration	Sedicanter
Feed rate (hl/h)	20 – 25	20 - 30
Feed solids (% by wt)	8 – 12	8 - 16
Cake solids (% by wt)	up to 20	24 - 28
Suspended solids in recovered beer (% v/v)	0	0.1 – 0.3
Recovery (%)	approx. 50	approx. 60
Oxygen pick-up (ppm)	<0.05	<0.05
Cooling required	yes, substantial	no
Production temperature °C	10 – 15	3 - 5
Installed power (kW)	75 - 100	30
Cleaning (CIP)	3 – 4 h (every 24 h)	2 h (every 120 h)
Operator skill required	high	normal
Maintenance costs	high (membranes)	moderate
General operating costs	very high	low

With Sedicanter installation, yeast suspension only passes once through the system and only little of the power is converted into thermal energy. Therefore beer and yeast are treated in a very gentle way without need for cooling. The ability of the Sedicanter to reach a higher cake dryness than membrane system results in a higher beer yield. Sedicanter has a reasonable payback period and due to its high reliability, maintenance costs can also be kept very low. CIP of the Sedicanter is very simple, short and can be done at much longer intervals compared to membrane system. CIP cycle in a membrane system is much longer and requires a huge amount of pure water and specialty chemicals.