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Keep it Craft

How craft brewers can benefit from the centrifugal separation technology

Joakim Gustafsson

Fernando Jimenez

Our speakers

Joakim Gustafsson

The global sales manager for high speed separators within craft breweries at Alfa Laval with a brewing diploma. Has five years of experience in the brewing industry besides being a home brewer for over ten years.

Fernando Jimenez

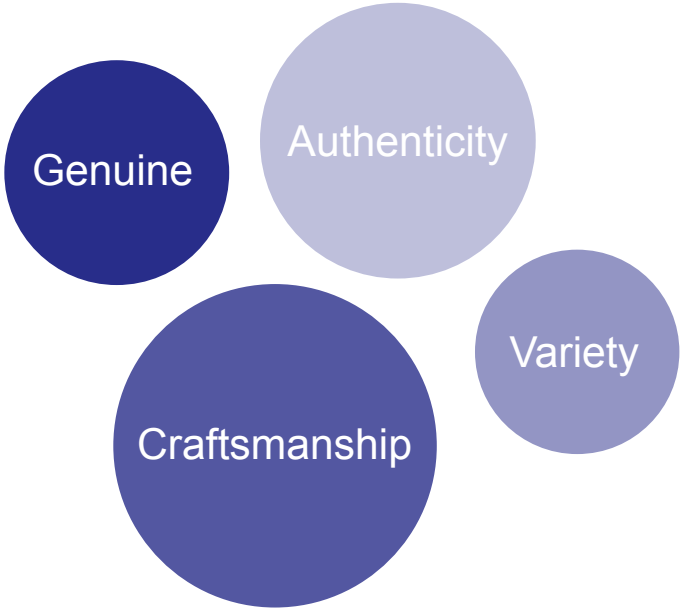
Holds a degree in Mechanical Engineering and works as the global business manager for brewery and beverages segment at Alfa Laval. Based in the United States, he is supporting centrifuge applications within the fast-growing craft brewing industry worldwide.

Agenda

- Background
- Reasons to install a centrifuge
- Centrifuges in brewery process
- Centrifuge technology. How it works
- Separation system as a tool
  to produce various beer styles
- Q/A

Background

Craft



Industrial

Challenges for the growing craft beer market

Craft beer production can start in a simple way with home brewing and brew pubs

Growing the production of craft beer puts a brew master in front of a dilemma:

How to keep the genuine quality while increasing productivity?

Challenges for the growing craft beer market

Growing craft beer production means:

- Implement consistency of production and final beer
- Deal with multiple beer styles
- Keep beer losses under control
- Improving shelf-life

How centrifuges can contribute to “keeping genuine craft” while improving beer output?

Reasons to install a centrifuge

Why use a centrifuge

- To clarify beer
- Reduce sedimentation time in fermentation tanks
- To remove solid particles: yeast, hops, crushed orange peel etc.
- To reduce beer losses
- To replace a trap filter clogging regularly

Centrifuge is a great tool for brewers

- Increase production capacity with the same number of tanks
- Offer a more linear beer turbidity, suppressing stratification effects
- Allow brewers to use new ingredients and provide control of the contact time with beer
- To control turbidity of beers
- Coarse solids removal
- Final haze adjustment

Filtration:

Alternative or complimentary

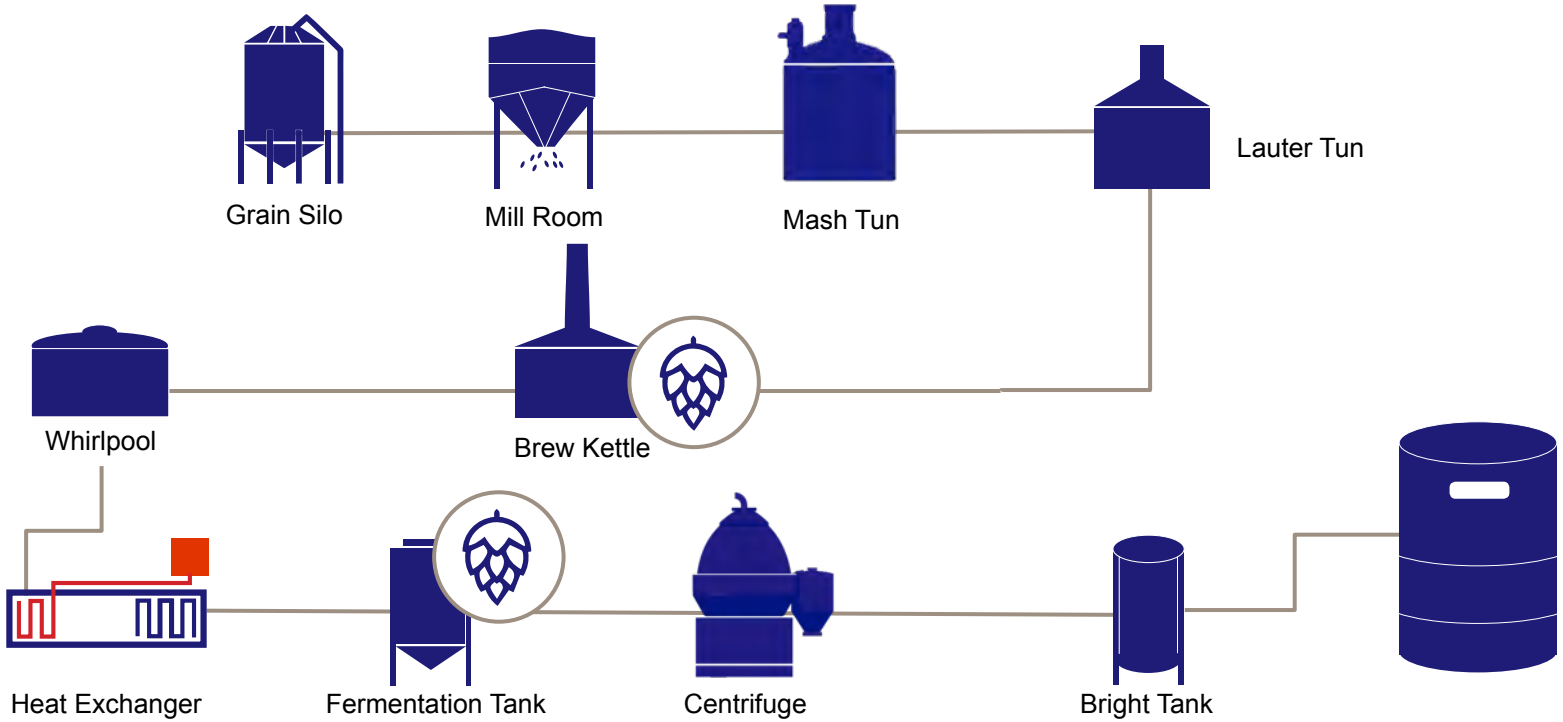
- DE filters
- Lenticular and other dead-end filters
- Combinations with centrifuge possible

Challenges of filtration

- Clogging
- Pressure loss
- Health risks
- Disposal costs
- DO pick up

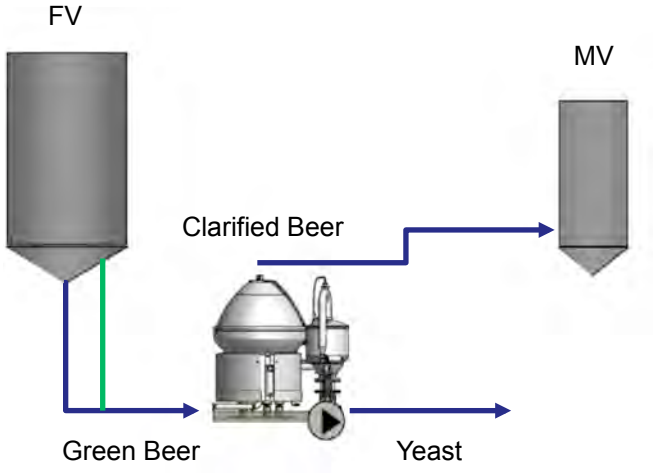
Centrifuges in brewery process

General Brewing Process Layout



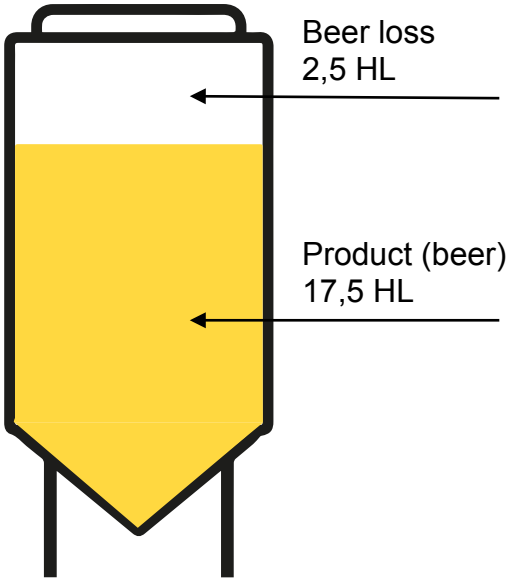
Beer clarification

- Quick and efficient removal of yeast, hops and other coarse solids
- Earlier transfer of the beer
  - Less time needed for cooling and settling of yeast and solids
- Less beer losses. Typically solids are ejected with dryness of 22-23% DM
- Defined yeast counts to maturation vessel or bright beer tank is possible
  - Consistent maturation
  - Secondary fermentation



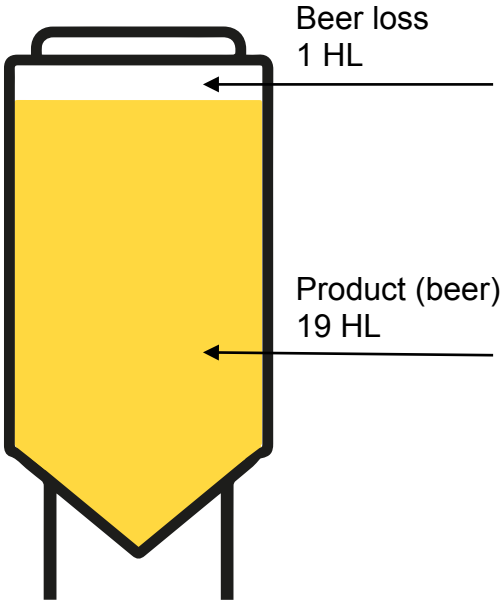
More yield with the centrifuge

Without a centrifuge



Bright beer tank – 20 HL

With a centrifuge

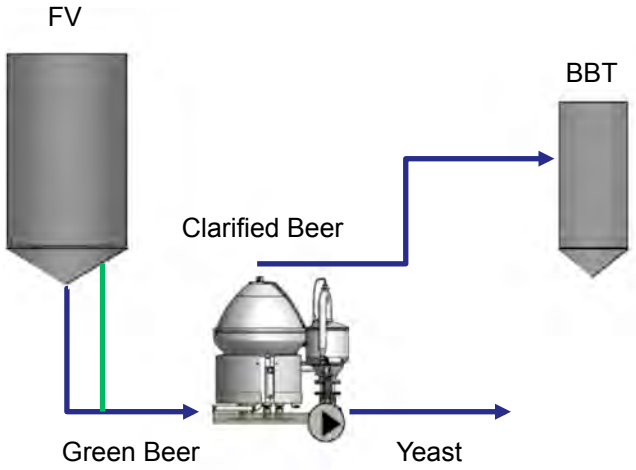


Bright beer tank – 20 HL

~8%
more yield if using a centrifuge

Beer polishing & Hazy beer

- Bright to near bright beer styles without filtering
- Reduces the consumption of potential filter aids
- Controlling proteins and polyphenols in centrifuged beer
- Possibility to adjust desired final haze



Centrifuge Technology

How it works

Separation technology today

Important parameters

- High separation efficiency
- Minimum oxygen pick-up
- Low product losses
- Low power consumption

From art to science

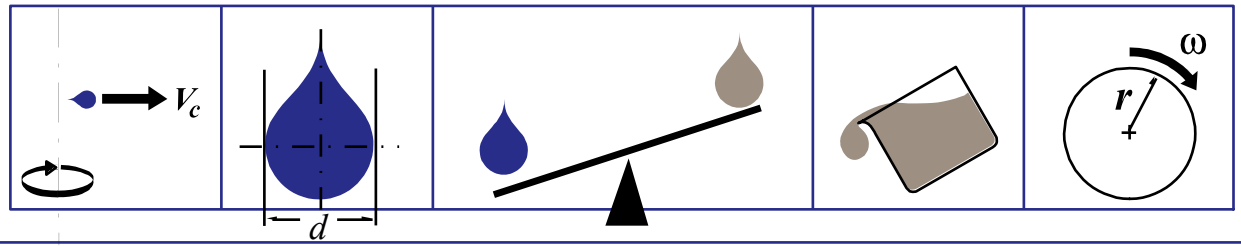
Centrifugal separation

Accelerated settling

8000-13000 g
4000 – 10000 rpm

$$V_c = \frac{d^2(\rho_w - \rho_o)}{18\eta} r\omega^2$$

V_c	d^2	ρ_w	ρ_o	η	$r\omega^2$
centrifugal settling velocity (m/s)	Particle size (mm Ø)	particle density (kg/m^3)	liquid density (kg/m^3)	continuous phase viscosity (kg/ms)	centrifugal acceleration (m/s^2)

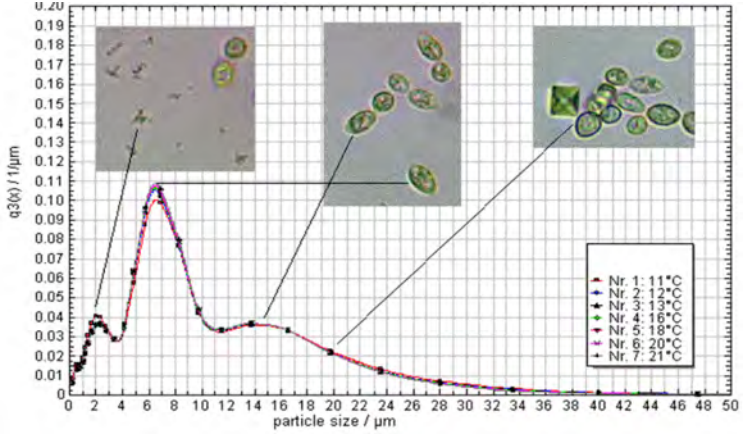


Avoid particle micronization is key

It’s not a filter. Is it a clarifier or polisher?
In fact, it’s a “classifier”

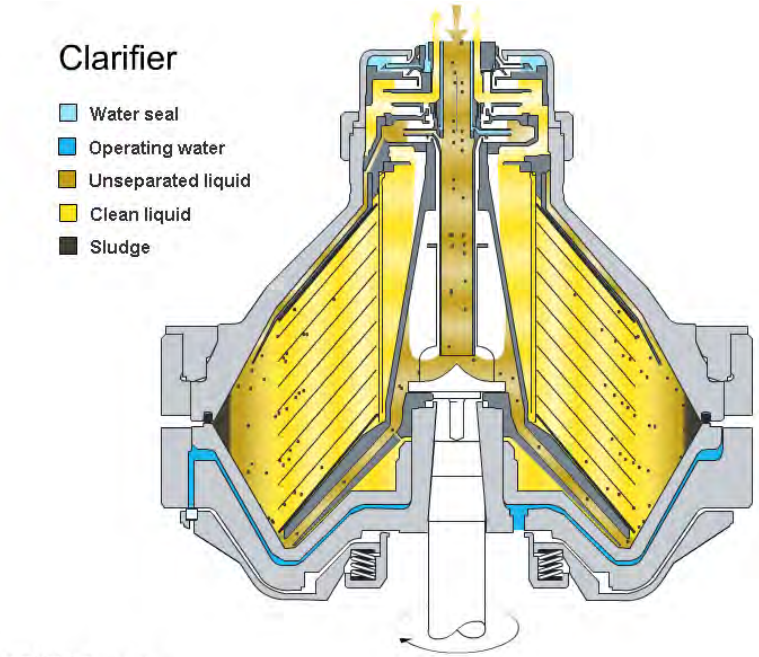
- Reduced flow
  - less large particles in the beer
- Increased flow
  - more large particles in the beer
- By-pass needed
  - for some hazy beers

Typical particle size distribution in lager beer

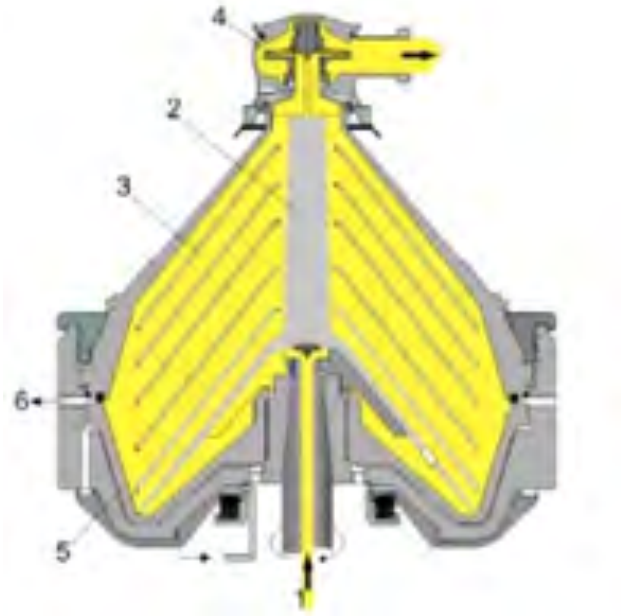


Increased flow

Bowl designs



Top fed design



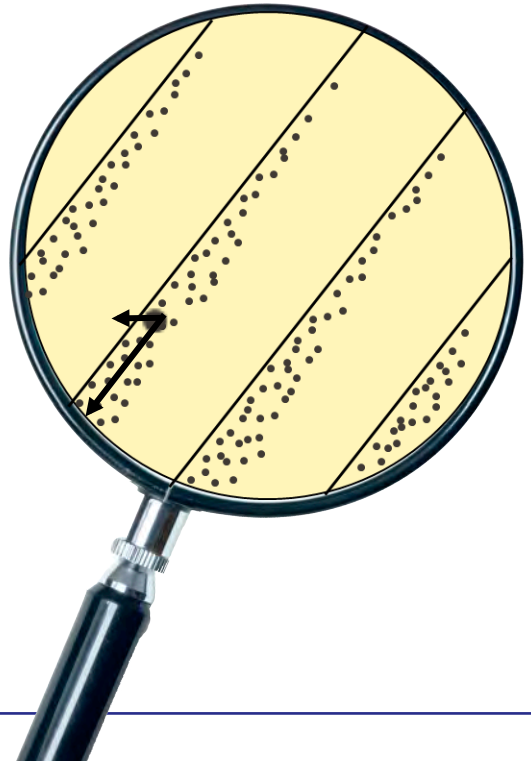
Center to center

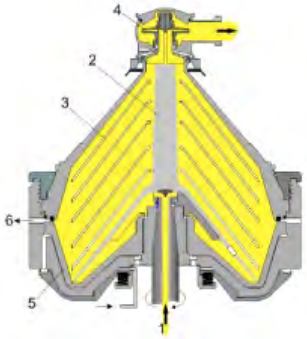
Minimum beer oxidation

- Less than 5-10 ppb DO pick up between inlet and outlet
- Different seal arrangements available in the market
  - Hydro-hermetic seal
  - Axial Hermetic seal
  - Double mechanical Seal

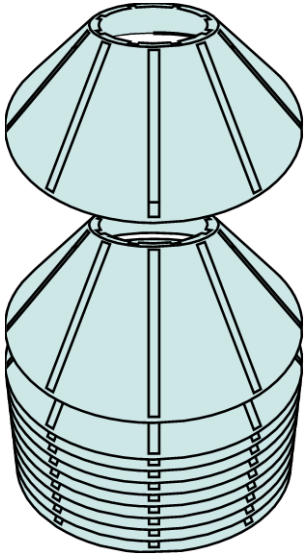
Design of the separator bowl

The disc stack



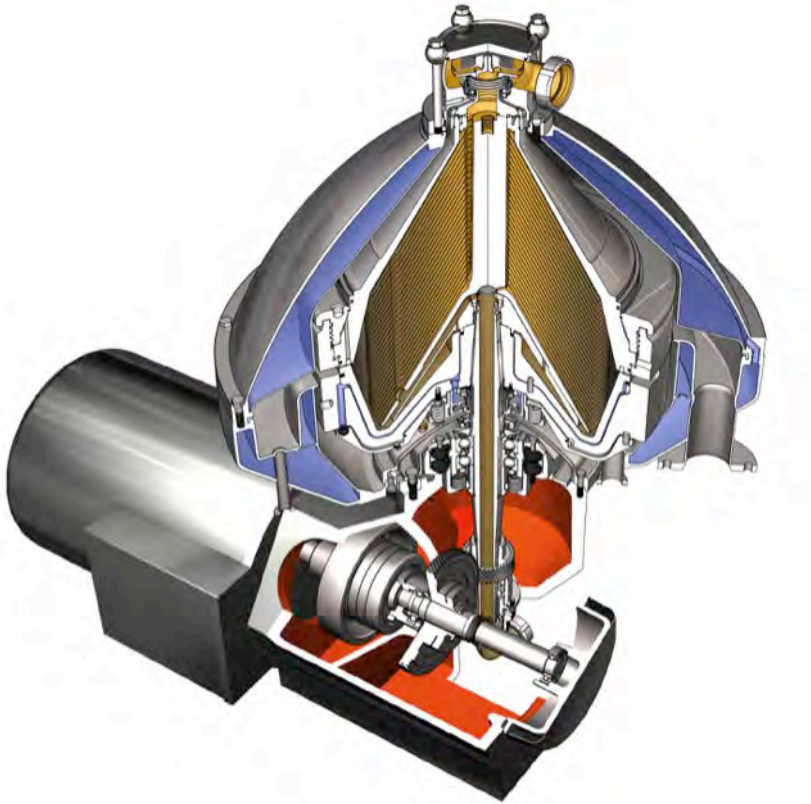


Separator bowl



The disc stack

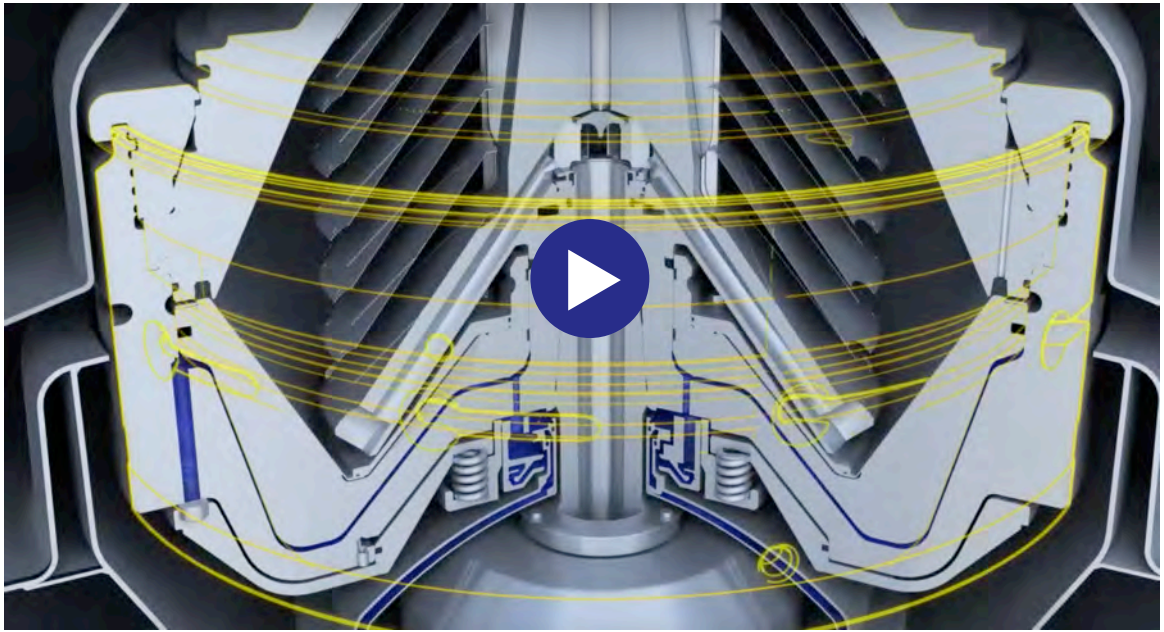
Beer Clarifier



Confidential

Beer clarification

Solids removal from liquid phase



Watch the video here

Separation Systems

www.alfalaval.com

Complete separation systems

- Centrifuge
- Process and service liquid modules
- Control system
- Motor starter / VFD
- Skid mounted (or modularized)
- Options for
  - Turbidity meter outlet for discharge triggering
  - Turbidity meter inlet for Inlet flow control
  - Automatic or Manual by pass
  - Tank bottom re-dosing
  - Cooling water recirculation

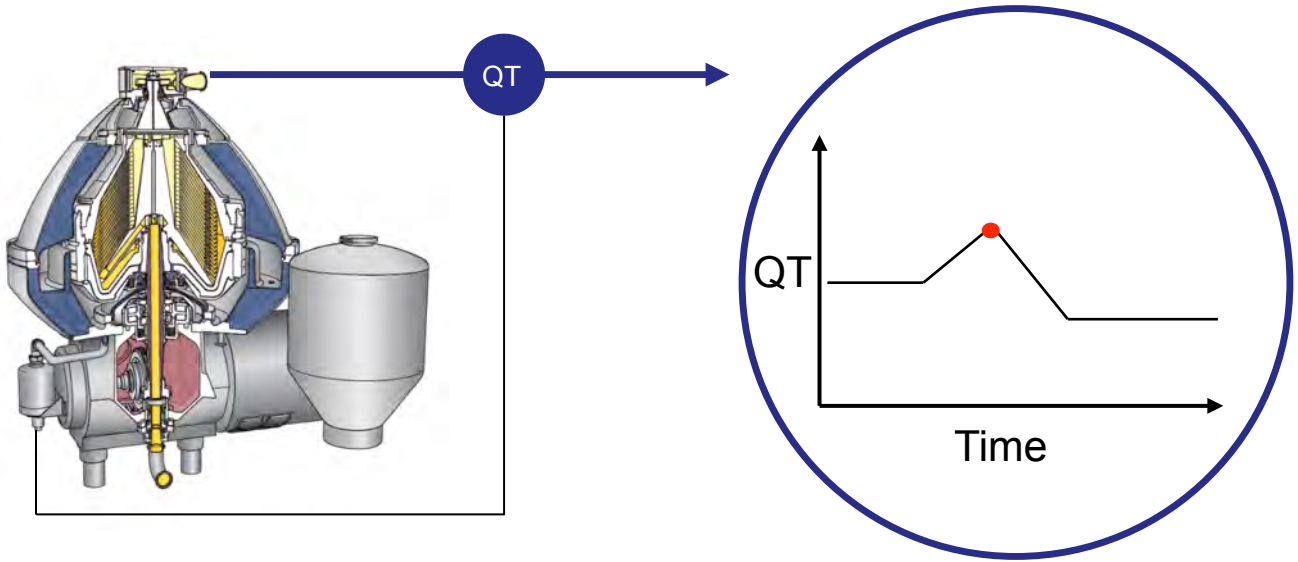
Complete separation systems

General centrifuge system

Watch the video here

Turbidity discharge triggering

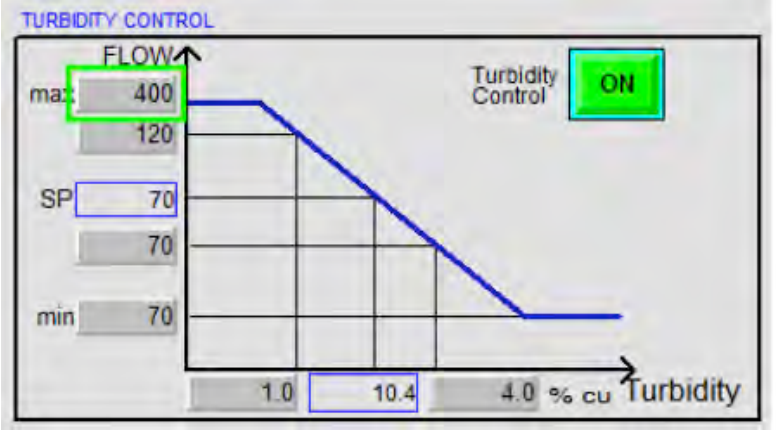
- For varying feed solids load
- High outlet turbidity indicate full solids space
- Discharge triggered before disc stack is blocked

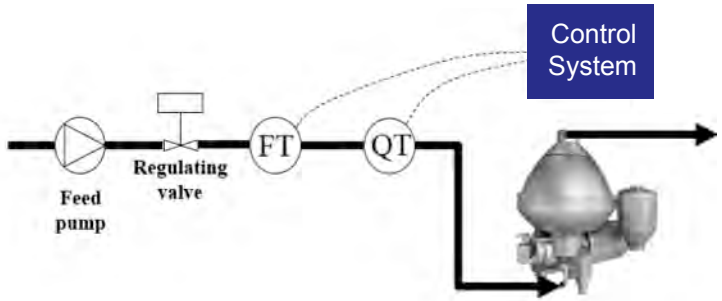


Capacity control

Capacity control automatically adapts feed rate:

- to avoid bad separation due to too high feed rate
- to avoid overfilling the separator with solids



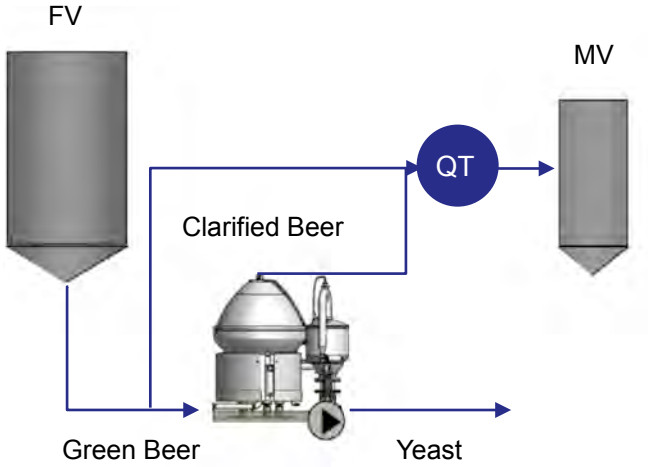


FT = Flow Transmitter
QT = Turbidity Transmitter

By-pass / Blending

Features & Benefits

- Proportional for defined haze level
- Both yeast and proteins will bypass
- Defined yeast counts to maturation vessel, which gives consistent maturation
- Can be manual or automated
- Bowl speed reduction as alternative



Centrifuge sizing example

- Size of fermentation vessel: **40 HL**
- Dry hopping rate: **500 g/hl**
- Solids concentration: **3,0% v/v**
- Required flow rate: **20 HL/h**

General recommendation
of size: **Brew 80**

Alfa Laval Craft Brew portfolio

Brew 20 Up to 15 hl/h

- High performance clarifier for capacities 4-15 hl/h
- Plug-and-play skid for simple operation and installation
- Low oxygen pick-up – Axial hermetic outlet

Brew 80 Up to 50 hl/h

- High performance clarifier for capacities 10-50 hl/h
- Plug-and-play skid for simple operation and installation
- Low oxygen pick-up – Axial hermetic outlet

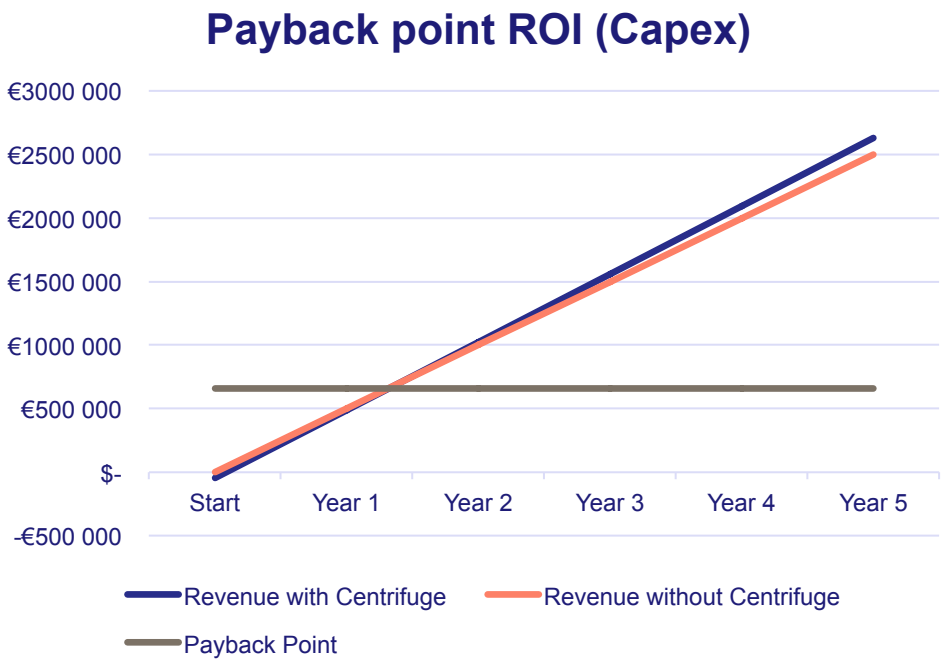
Brew 250 Up to 180 hl/h

- High performance clarifier for capacities 10-180 hl/h
- Plug-and-play skid
- Center to center
- Zero oxygen pick-up and low power consumption

Return of investment example

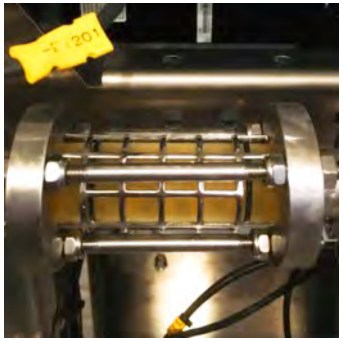
- Fermentation vessel: **20 HL**
- Yearly production: **2000 HL**
- Suggested flow rate: **5-10 HL/h**
  → **Brew 20**
- Recovery rate for IPAs –
  Yield increase ~ **7%**

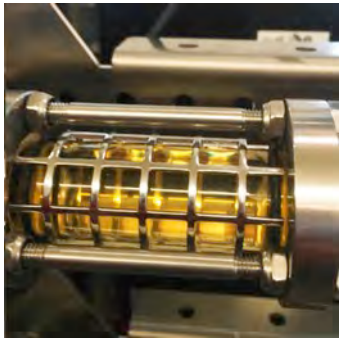
- Beer sales: **€2,5/L**
- Return of investment:
  → Less than **1,5** years



Beer clarity

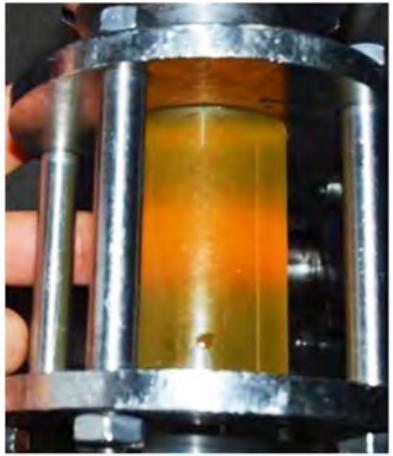
Pils





IPA

Clarification vs Polishing



Clarifier type:
removal of the bigger particles such as yeast or hop particles

Polisher type:
removes smaller particles > also reduces the chill haze

For bright and hazy beers

Features & Benefits

- Polishing - Bright to near bright beer without filtering
- Degree of polishing defined by inlet flow. The lower the inlet flow, the clearer the beer.
- Hazy beers using either variable flow rates, variable bowl speed or by bypassing

Centrifuges in breweries

A centrifuge will contribute to:

- Clear beer with less or no filtering
- Quicker tank turn-over
- Beer recovery
- Reduced product loss
- Improved filter performance
- Controlled haze in the beer

Thank you for your participation!

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- Please, visit our pages:

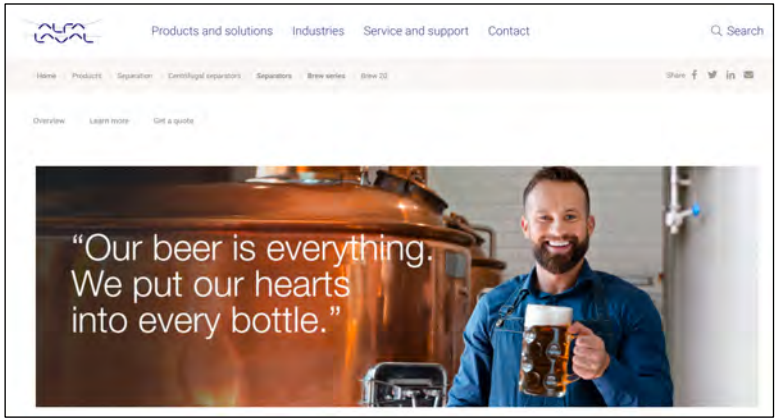
  https://www.alfalaval.com/brew-series

  https://www.alfalaval.com/brew20

  Fill in the online form on one of these pages and send your request

- Or send us an email:
  elena.krivovyaz@alfalaval.com

- The recording of this webinar will be sent out to the participants in October



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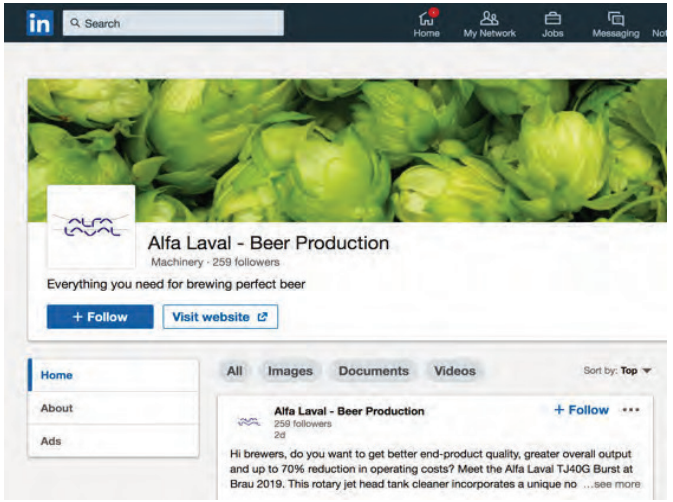

Next webinar:
Beer Dealcoholization

Date: 21 Nov 2019
- **10:00 - 11.00am CEST**
- **4:00 – 5:00pm CEST**

In this free webinar our expert Juan Jurado will share with key aspects to consider when producing quality non-alcohol beer that meets market demand:

- What are the latest market trends and demand drivers for 0.0 beer products?
- How to achieve successful taste from some unique dealcoholization technology?
- Why should you consider your provider's brewery know-how, technical support and extended process solutions when making dealcoholized beer?

Register for the webinar here


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