Finishing Processes:

From Brilli(A)nt to Ha(Z)y
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Objectives

Provide overview of finishing processes

Review finishing and stabilization regimens for:
- Pilsner
- English Ale
- Witbier
- New England Style IPA

How to tweak your equipment to suit several different styles

Performing efficient changeovers between styles
Goals of Finishing

Appearance
While appearances vary significantly, still an integral component of style
Indication of whether we finished the beer to our standards

Stability
Should be the same when we would pull it off the shelf as it was on day one

Flavor
Remove bitterness, “roughness”, yeast and/or hop bite

Results based as much on design and upstream processes as on day-of finishing process
How?

Select removal of particles

Conditioning

Finings

Separation

- In tank
- Centrifuge
- Filter
General Recommendations

Start from your end goal and work backward

Pay attention to upstream practices

Set up templates for producing similar styles

Put a premium on operator training
Conditioning

Time

Temperature

Colloidal stability

Protein/polyphenol complexes, precipitation

Flocculation and sedimentation of yeast
Finings Overview

Typically work by binding either to yeast/proteins or tannins/polyphenols

Proteins: isinglass, silica, tannic acid
Tannins: PVPP
Some products are a combination

Larger, denser particles settle faster

Hot and cold side options

Yield and chill proofing benefits
Separation – Settling

Settling in fermentation vessel, bright tank, centrifuge

Stokes’ Law

\[ V = \frac{2(\rho_p - \rho_f)}{9\eta} gR^2 \]

- \( V \) = settling velocity
- \( \rho_p \) = particle density
- \( \rho_f \) = fluid density
- \( \eta \) = viscosity
- \( g \) = force of gravity
- \( R \) = particle radius
Silica Finings

Can be used either in tank or inline

FDA: silica can be used as a stabilizer in production of beer provided it is removed by filtration prior to final processing

Use lowest effective dose and size finishing filters to remove particles prior to packaging—consult suppliers on particle sizes and finish filter recommendations

Can be combined with PVPP for two-part stabilization
Sample In-Tank Silica Process

• Day 0 – 5: Ferment completely
• Day 6: Crash to 40 F
• Day 8: Dump yeast
• Day 9: Mix silica xerogel slurry at 0.15 lbs per bbl & crash to 30 F

• Day 12: Rack off cone, transfer through 5μ cartridges to BBT
• Day 13: Carbonate
• Day 14: Package
PVPP finings

More expensive than silica but used at lower rates

Generally later in process, combined with or after silica

Per FDA, can be used in beer as a clarifying agent, at a residual level not to exceed 10 ppm

Use lowest effective dose and size filters accordingly
Separation - Filtration

Darcy’s Law:

\[ Q = \Phi \frac{PA}{LM} \]

- **Q** = flow rate
- **Φ** = permeability
- **P** = pressure drop
- **A** = surface area
- **L** = thickness
- **M** = viscosity
Types of Filters

- Cartridge
- Sheet
- Pressure Leaf
- Crossflow
Cartridge Filters

Cheaper asset cost
Simple to operate
Possible to store cartridges for reuse
Media more expensive
Sheet Filter

Wide range of media for different applications
- Cellulose
- DE (adsorptive)
- Carbon

Sometimes configured in two stages, coarse/fine

Sheets can be backflushed and cleaned in place

Photo courtesy of ATP Group
Pressure Leaf Filter

Generally highest $\Delta$Ps
Media relatively cheap
High capacities
  Flow rate
  Sludge
  Overall throughput

Complicated to operate
Dust handling
Disposal

Photo courtesy of ManCel Associates
How to finish a...

- German-style Pilsener
- English Brown Ale or ESB
- Belgian-style Witbier
- Juicy or Hazy IPA
German-style Pilsener

BA style guideline: Appearance should be clear. Chill haze should not be present.

- Lager for 2-4 weeks
- Finings for clarity and stability
- Consider polish filtration and chill proofing
English Brown Ale or ESB

BA style guideline: Chill haze is acceptable at low temperatures.

- Use a flocculant yeast strain
- Condition cold for a week or more
- Consider using finings, which must be removed by filtration
Belgian-style Witbier

BA style guideline: Unfiltered starch and yeast haze should be visible. Wits are traditionally bottle conditioned and served cloudy.

- Dump yeast and rack to BBT, consider using coarse filter through transfer

- If you have a centrifuge, you can adjust bowl and product speeds to tune haze
Juicy or Hazy IPA

BA style guideline: Low to very high degree of cloudiness is typical of these beers. Starch, yeast, hop, protein and/or other compounds contribute to a wide range of hazy appearance within this category.

• Maximize haze complexes that contribute to hop aromatics; minimize haze that does not (e.g., yeast)

• Whirlpool temperature, adjuncts, yeast strain, dry hops are all important

• Maintaining haziness without carrying over particulate can be challenging
Efficient Change-Overs

Production Order
  Light $\rightarrow$ dark
  Mild $\rightarrow$ strong
  Clear $\rightarrow$ hazy

Group similar styles
  Filtered beers together, unfiltered, and so on

Helps minimize setup and cleaning between batches
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