Kettle Souring at Breakside Brewery

CBC 2015 Ben Edmunds

Overview and Scope

- Began experimenting with sour wort production in the kettle in 2010 with increased focus in 2012 and early 2013.
- Scaled to 30 bbl production length in 2013.
- Produced ~1000 barrels of beer using kettle souring in 2014; similar target in 2015
- Two core seasonal beers use kettle souring as part of production and derive most of their acidity: Passionfruit Sour Ale (Berliner weisse with lilikoi) and La Tormenta (dry hopped sour ale, not 100% kettle soured).
- Other seasonals/rotating beers that use kettle souring include
    - Juggling Plums Gose > Leipziger-style gose with salt plums
    - Birra Minestra > golden ale with tomatoes and pluots
    - New World Bruin > Flanders-style red ale
    - Bellwether > gin barrel-aged sour double wit with kaffir lime leaf
    - Framboise > sour raspberry ale with cinnamon and dragonfruit
- **Philosophy: kettle souring is a tool and rarely an end in and of itself.**
- Typically against the production of extremely sour (<3.2 pH) beers

Basic Info

- Strain: Wyeast Lactobacillus (#5335) NB: hop and alcohol intolerant
- Target pH at start of souring period: 4.6 or lower.
  - 4.6 pH with lower pitch rate of lacto has had quicker drop than lower starting pH with higher pitch rate
- Time varies with pitch rate and health of lacto, but typical souring time is **18-72 hours**
- Target finishing pH varies with brand, but typically we seek a finished kettle pH of 2.9-3.3.
- Target finished beer pH also varies with brand but typically is in 3.2-3.5 range for strongly sour beers. “Blended” beers with kettle soured component usually in the 3.6-3.8 pH range.
- Have found that Lacto will not drop below its own pH in 72 hr period.

Process

- Kettle CIP before any kettle soured batch
- Pre-pack heat exchanger with sanitizer or pasteurizing temp water
- Runoff as normal
- Bring wort to boil for 5 minutes
- Treat kettle as a sanitary cellar vessel from here forward.
- Recirculate through HeatEx until temp is below 120 deg F.
- Push wort in circulation back into kettle with CO_2. Agitate kettle to homogenize sweet wort.
- Innoculate with live lacto. Set kettle to hold temp between 108 and 115 deg F.
- Agitate kettle with CO_2 3-5 mins
- Blanket with CO_2 at 2 psi with stack fan on overnight
- Once target pH is reached, rack off desired vol. of new lacto prop and bring to boil; knockout as usual to cellar.

****For certain beers we do not boil wort and allow indigenous bacteria from grain to contribute to souring culture****

Grist Bill Formulation

- Clean Pilsner or Two Row Malt
- Rest of grist bill typically includes wheat, dextrin malt, Vienna, some light crystal (20 deg L or lighter).
- Acidulated malt to drive down wort pH going into kettle.
  - added after saccharification rest
  - target runoff pH of 4.5-4.7
  - composes roughly 10% of total grist
- Interaction of darker crystal malts with Lacto tends to produce an undesirable nutty character during kettle souring.

Pitch Rates, Temperatures, and pH

- Temperature optima seems to be 105-120 deg F.
- Pitch Rate and pH drop
  - 4-12% by volume pitch rate
  - We do not count lacto cell density > prefer pitching by volume ratio
  - If lacto is healthy, we've seen pitch vol as low as 4% drop pH quicker than 10% pitch by vol rate
  - Lacto health/vitality seems to be most important variable to rapid pH drop
  - Lower than 4% by volume has taken 2-3 days longer than 4-10% by volume pitch.
  - Lacto stored over 1 month is still viable but typically needs re-prop before use in a large batch.
- Most pH drop occurs in first 18-24 hours; any time after 24 hours typically means only a .2-.3 pH additional drop.
- **"Rule of thumb" is that we look for kettle pH of 3.4 or lower in 24 hours.**

Pitfalls and Troubleshooting

- “Dirty” lacto character and autolytic flavors
- Loss of vitality in lacto that has been in storage
- Exopolysaccharide production
- Change in pH if doing high gravity brewing/kettle dilution
- Missing target gravity if lacto gravity does not match wort gravity
- Overuse of bulk CO_2 to blanket kettle

Production Brewery Considerations

- Alternative storage locations for souring if kettle can’t be used regularly
- Multiple fermenter fills and blending non-sour wort into sour wort
- Wort supplementation vs. wort souring in the kettle

Fermentation Considerations

- Aeration and pitch rate
  - Standard aeration rate
  - Pitch rate slightly elevated for ale pitch at 1 x 10^6/ml/deg P
- Yeast strain selection
  - German Ale strains (WLP 029, for example) purportedly show better attenuation in high acid worts, but we've seen very little difference in flavor and attenuation when using 001 or other med-high attenuators
  - Prefer clean American or German strains and then blend soured beer.
- Yeast Nutrients
  - Zinc Sulfate added at 10 min before flameout
- Re-pitching
  - Only in worst case scenarios: attenuation drops by 5-6% in a single generation when harvesting from high acid ferments
- Improving ADF > enzyme use

Finishing Beer and Blending

- Unblended kettle soured beer (100% kettle soured) - very rare at Breakside; cellar configuration doesn't permit this and general preference internally is for less sour beer

- 50% blends still remain very sour
  - 50% wort at 5.3 and 50% wort at 3.1 > 100% wort at 3.4-3.5 and finished beer in the same range
  - pH scale is logarithmic

- 20-50% blends tend to have moderate acidity

- blends with less than 15% kettle soured volume
  - noticeable tang or tartness, but typically not enough for us to call them "sour"

- May be desirable to blend with extremely dry beer to offset the lower ADF/higher RE found with many kettle soured beers. Acid blend is also an option for adjusting perceived acidity.

Case Study: Bellwether

- Blended beer using 20% kettle soured beer and 80% non-soured beer
  - 80% Double wit aged in gin barrels for 7 months
  - 20% Double wit kettle soured and aged on Thai lime leaf

- At 20% blend, the objective was to add noticeable but balanced acidity to a barrel-aged beer that had lost some of its vibrancy due to aging.

- Base beer for kettle soured version mimicked barrel-aged beer in every way possible, accounting for adjustment between two brewhouses.

Thank You!

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Kettle Souring

CBC 2015

Ben Love

Overview

- Produced seasonal beers + collabo beers at other brewery's
- Use both Wyeast 5335 & Yogurt
- Prefer Yogurt culture's very clean sourness
- Sourness from Lactobacillus is building block

Process

- Mash
- Lauter
- Bring to boil/heat to pasteurize
- Cool to pitching temp 110-118F (43-48C)
- Pitch lactobacillus
- CO2 purge
  - 2 hours at 3 psi
- Acidification
- Boil and kill lactobacillus

Acidification in Kettle

- Pitch 48oz Nancy's Greek
  Nonfat Plain Probiotic
  for 15 bbls (20bbl preboil)

- Goal is pH 3.4-3.6
- Takes 16-24 hours
- Average drop in kettle .5 plato

Fermentation

- Prefer clean fermenting yeast
- Belgian strains + ester production issues
- Fermentation follows normal track

Beers Produced

- Wit
  - TicWitTic (collabo with Ecliptic)
- Hoppy Beer
  - Super Duper - Dry Hop Crystal Sour (collabo at Automatic)
  - Craftylicious - 50/50 Kettle Sour w/ Dry Hop (collabo at Widmer)
  - Craftylicious II: Hoppy Sour Boogaloo
- Fruit Beer
  - Who Ate All the Pies - Strawberry Rhubarb Gose
  - Boysen the Hood - Boysenberry Sour
  - Tainted Love - Passionfruit + Juniper (collabo at Fork & Brewer)
  - Fancy Pants – Raspberry Sour

Fancy Pants Raspberry Sour

SG: 12 FG: 1.8 5.7% 18 ibu

Kettle Sour took 16 hours 5.7pH -> 3.42pH

88% Weyermann Pilsner

6% Weyermann Carahell

6% Torrified Wheat

42# Oregon Fruit Products Raspberry

Scottish Ale Yeast WY1728 at 70F

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Kettle Souring:

THE COMMONS BREWERY

The Commons Brewery's Approach to Wort acidification

By Sean Burke

Cbc 2015

objectives

- Hold Wort in desired temperature range
- reach Certain pH
- Boil wort to kill off bacteria

THE COMMONS BREWERY

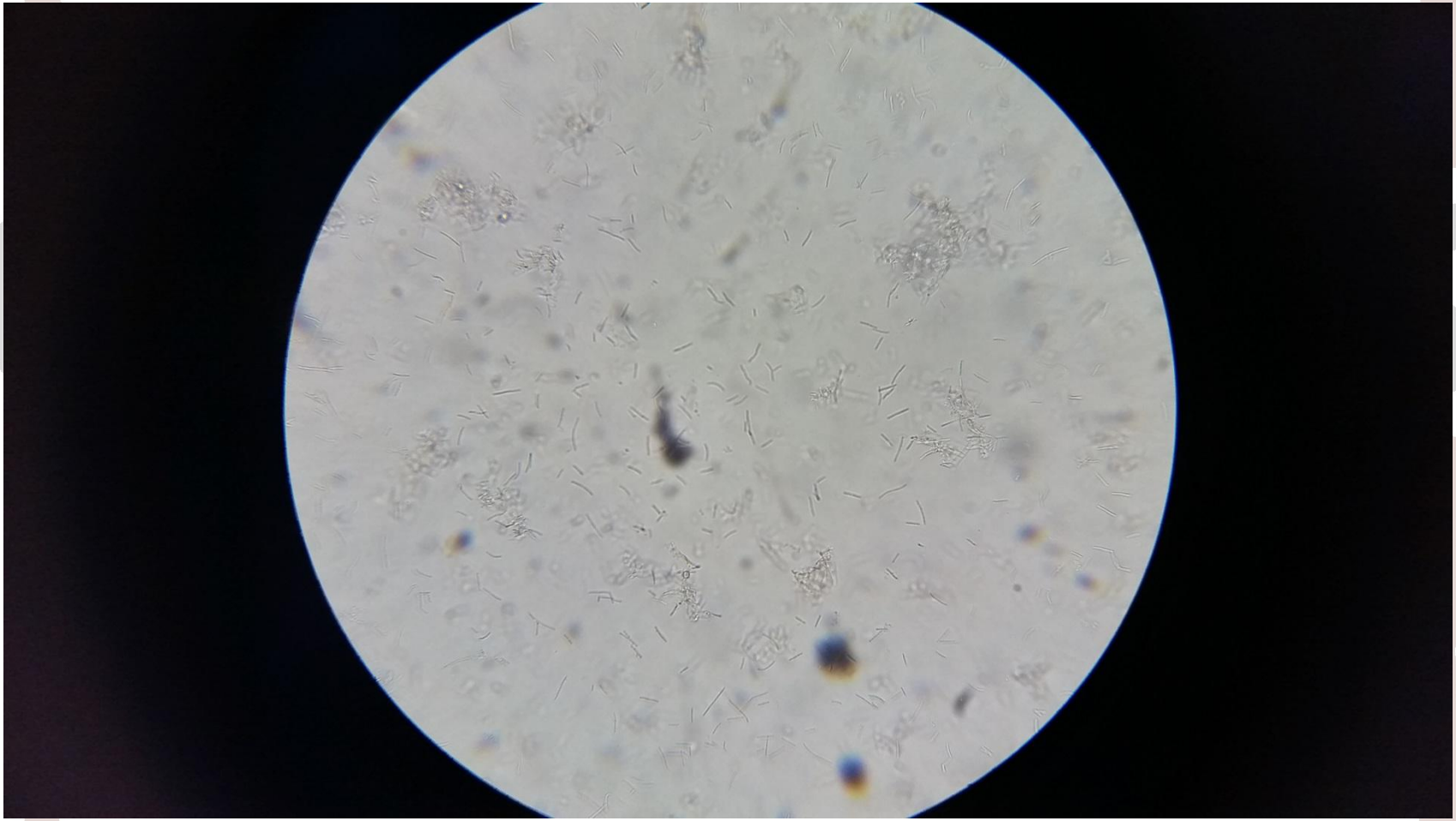
Source

- Lab
- Bottle Culture
- Nature?
- Yogurt

Process

- Mashing
- Wort Collection
- Pasteurization vs Boiling
- cooling to pitching temp
- Pitching with lactobacillus
- pH monitering
- Boiling

Details



Details

- Recipe Formulation
- Mash Temperature
- Protein Degradation
- desired pH

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Storage

Pitfalls & Considerations

- Keeping culture pure
- Anaerobic environment?
- DMS volatilization
- Cleanliness
- Stressful environment for most saccharomyces
- Pitch rate/yeast nutrient

THE COMMONS BREWERY

soapbox

- What is sour beer?
- Kettle Souring is a tool
- Sometimes it's worth the wait

credits

Special thanks to:

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- Ben Love & Ben Edmunds
- Robert Goldman p.h.d.

deviantfermentations.blogspot.com

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