Tips for Improving Your Homebrew

Use Fresh Ingredients

Garbage in – garbage out.

- **Stored grains can become stale**
  - **Whole grains are more resilient than crushed grains**
- **Hops can oxidize, lose aromatics, and take on vegetal qualities**
- **Yeast loses viability**

Embrace good storage techniques

- **No light**
- **No oxygen (CO_2 baths)**
- **Cold temps**

Sanitation

- **Cold side**
  - Hoses, gaskets, carboys, buckets, airlocks …
- **Bottles (caps), kegs (gaskets)**
- **Star San – don't fear the foam!!**
  - <2.5 pH
  - Not as effective at killing micro-orgs that create acid (lacto)
- **Heat**
  - +175 degrees, 10-15 minutes
  - Boil, oven, steam (dishwasher)
- **Iodine (iodopher)**
  - Will stain equipment after awhile (Buckets, hoses)
- **Alcohol**
  - Made by beer
  - Great for adjuncts (Vodka)
- **Bleach – must rinse …. Don't use it.**

De-Chlorinate the Water

- **Chloramine**
  - Ammonia treated chlorine
  - Leaves a residual taste in beer
- **Remove it!**
  - Aerate (Chlorine)
  - Boil (Chlorine)
  - Camden tablets (Chlorine/Chloramine)
  - Carbon Filters (RV Filters)
  - Store purchased water

Manage pH

Measures how acidic/alkaline a solution is

- 7 is nuetral … 5 is 100 more acidic than 7 (Algorithmic)
- Should target 5.2 in mash

Why it matters

- Better enzyme activity and starch conversion
- Lower pH in the finished wort which improves yeast health during fermentation, and also inhibits bacteria growth
- Improved hop extraction rates in the boil
- Better protein and polyphenol precipitation both during the cold break and post fermentation
- Improved clarity in the finished beer with reduced chill haze
- Improved flavor and clarity stability as the beer ages

Don’t Over Sparge

- **Sparging is adding brewing liquor to the mash in order to rinse the sugars from the malt.**
- **Lautering is the process of separating the wort from the mash.**

- Sparging tends to increase solution pH
- Lautering compacts the grain bed and reduces the sugars in the mash solution
- The effect is to increase the amount of tannins we draw off from the grain husks
- The result being perceived as astringency

Best practices:

- Don’t use sparge water over 170 degrees
- Acidify your sparge water to reduce pH below 6.0
- Cease lautering when run-off is below 1.010
- Maintain layer of HL on top of mash to prevent squeezing the grain bed

Boil it Good

- A good boil sterilizes/pasteurizes the wort
- Enzymes are de-natured, setting the carb/sugar profile
- Proteins “break” from solution, fostering clarity and less heavy mouthfeel
  - Tannins “floc” with protein break and drop from solution
- Hop alpha acids are “isomerized” and made soluble
- DMS is volatilized and boiled off
- Caramelization of sugars takes place
- Maillard reaction occurs (protein reaction to heat)
  - Adds flavor complexity and color to beer
- Hot solution is conducive to adding sugars and adjuncts
- Wort is concentrated due to evaporation
- pH levels are reduced
- Oxygen is boiled off

Best Practices: Boiling

- Leave headroom in kettle
- Don’t cover kettle
- Use kettle with clad bottom
- Wait until initial hot break subsides before first hop addition
- Reduce heat when adding hops
- Keep spray water bottle on hand
- Post boil pH should be around 5.2
  - Add gypsum if necessary
- Add aromatics at flame out
- Don’t scorch sugars/grains/adjuncts at bottom of kettle

Chill it Good

Facilitates cold break: More proteins and solids fall out of solution

Reduces exposure to potential contaminants

- A sugar solution at <160 is optimal for beasties, before yeast have chance to colonize

Chilling methods

- Create concentrated wort and top off with chilled, sanitized water
  - Pro: enables brewing volumes that exceed kettle size (extract)
  - Con: More work; water added late will convey watery character to beer
- Soak kettle in ice bath (or snow in winter)
  - Pro: Cheap
  - Cons: Takes longer to chill; requires lift of heavy pot of boiling wort
- Immersion Chiller
  - Pro: Can easily sanitize chiller in boil; leaves break in kettle
  - Cons: Takes longer than alternatives
- Counterflow Chiller/Plate Chillers
  - Pro: Quick and effective chilling
  - Con: More difficult to clean; break ends up in fermentation vessel

Oxygenate the Wort

Yeast need oxygen to synthesize sterols and unsaturated fatty acids for cell membrane biosynthesis. Without aeration, fermentations tend to be underattenuated because oxygen availability is a limiting factor for yeast growth—the yeast stop budding when sterol levels become depleted.

- You boiled the oxygen out of the wort
- O2 is essential during lag phase
- Need about 10ppm O2
  - Shaking, stirring, splashing = 4ppm
  - Aquarium pump = 8ppm
  - **Pure O2, 60-90 seconds at 1Liter per minute = 10-14ppm**

Don't Oxygenate the Beer

Oxidation is the loss of electrons during a reaction by a molecule, atom or ion. While the term implies O2 as a catalyst (which it is), it is a legacy term as various compounds can serve as catalysts.

In brewing, oxidation is associated with aging and staling of beer (stability)

- Papery, lipstick, rotting veggies, sherry-like, vinous, toffee, butter (diacetyl)
- Other "oxidizing" compounds in beer include yeast enzymes and melanoidens

Tips for reducing oxidation

- Limit agitation of mash (hard stirring)
- Don't splash hot wort (conventional wisdom is >90 degrees)
  - Lautering, Chilling
- Reduce headpace in fermentation vessels, kegs and bottles
  - Cap with CO2
- Don't splash during transfers
- Store cool and limit movement of beer
- Use O2 absorbing bottle caps
- Consider the permeability of fermentation vessels (buckets vs glass vs barrels)
- Don't over-do the number of samples you pull from carboys

Pitch Enough Yeast

Pitching Rate

- Assuming high viability; generally a function of style (desired character), OG, and fermentation temperatures.
- Typical vial of WL, or Smack Pack, or dry yeast pak contains about 100B cells …

.5 million cells per milliliter of wort per degree Plato (Fresh Culture)
1 million cells per milliliter (Harvested Yeast)
Double for Lagers
Plato is roughly gravity points/4. So 1.040 = 10 degrees Plato
Roughly 4000 ml/gallon (3785)
= 2B cells per gallon per degree Plato

1.060 Wort = 15 Plato
500,000 x 4000 x 6 x 15 = 180,000,000,000 (180B Cells)

WAG Method with Harvested Yeast = about 1.5B cells per 1ml of thick slurry (that which is settled on the bottom) = 120 ml of thick slurry in above example

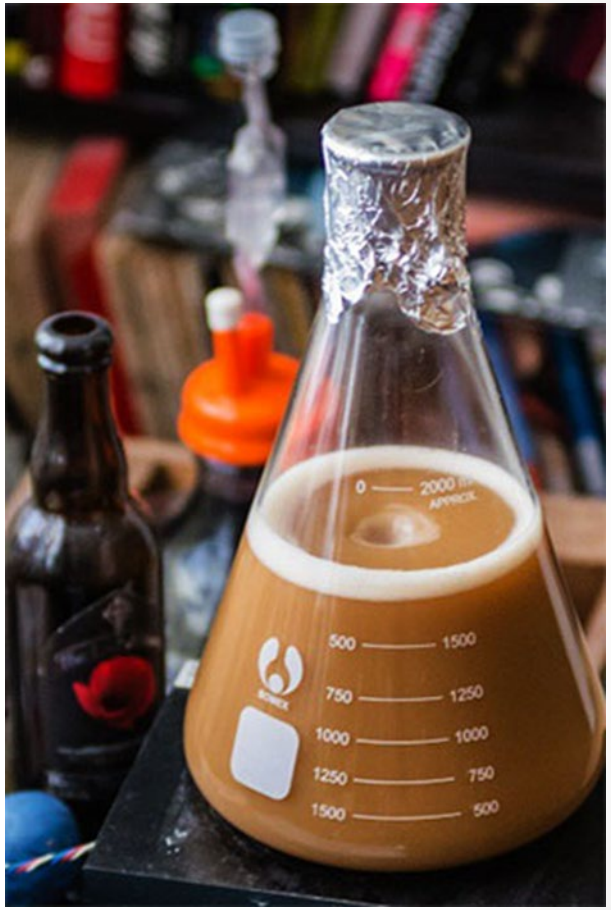
Yeast Starter

Yeast Starters

- Increase cell count, cell membrane health, and get them warmed up
  - Glycogen, trehalose (reserves for lag phase)
- Pitch yeast in approx 2L of sterile 1.040 wort
  - 4L for lagers (step up)
  - Add nutrient, aerate (place on stir plate)
  - 18-24 hours after krausen settles (out of sunlight), decant, pitch
  - Canning wort
- Good practice is to pull off pint of fresh starter to store for another batch

Hydrating dried yeast

- Boil a pint of water to sterilize
- Let cool to 95 degrees
- Add dry yeast and shake
- Let cool to pitching temp



Fermentation Temperature

Steady temp at approx 62-65 degrees for ales; 48-52 for lagers

- Primary fermentation will add 3-4 degrees to ambient

Recommended Schedule

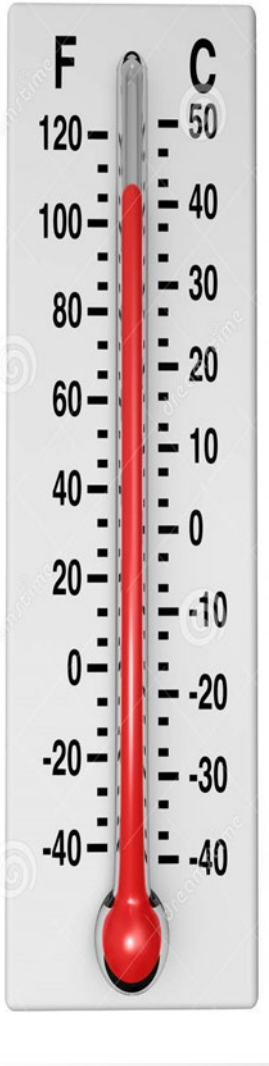
- Pitch 3-5 degrees below target and allow temp to rise over 24 hours
- Hold temp steady for 2/3 fermentation schedule
- Final 1/3 of schedule, raise temp 6-8 degrees to foster finishing, conditioning, and attenuation (unless already at high temp: Belgians)
- Crash: drop temp significantly (< 40) to drop from solution

How to cool

- Evaporation
- Recirculation
- Insulated box with milk cartons of ice
- Freezer with controller

How to heat

- Wrap in blanket
- Aquarium heater in bath
- Insulated space/box with heat source (lamp) and controller
- Ferm Wrap



Let the Beer Finish

Patience is a virtue!

- **Just because you hit your target gravity, does not mean the beer is finished.**
  - Many yeast by-products still reside in beer (diacetyl, acetaldehyde)
  - Flavors have yet to meld into a composed and complimentary state
  - Much of the yeast is still suspended in solution
  - This is called “green” beer
- **As long as yeast is present, beer will continue to evolve**
  - It begins consuming/metabolizing its own by-products in absence of sugar
  - Alcohol is ‘esterified’ into a smoother, more fruity/spicy character
  - The beer continues to attenuate, further drying out the sweetness
  - As food is reduced, yeast and other compounds will drop out of solution, thereby smoothing the flavor and character and clarifying beer
    - Can be aided by “cold crashing”
- **Pro Tips**
  - Give beer 2-3 weeks beyond attenuation phase to condition
  - If long conditioning high gravity beers – move to secondary to get off trub
    - Also, place in lower permeability container (glass)
    - Prevent Autolysis and fatty acid excretion

No Light on the Beer

Lightstruck

- Skunky beer is caused by **ultraviolet light**, that split apart the alpha-acid molecules from hops.
- These dislocated hop particles combine with sulfurous molecules from the beer's malt to create a new compound known as 3MBT
- Reaction literally takes seconds, so aside from those imports that come in green and clear bottles, beware your glass of homebrew sitting next to the BBQ

Prevention Tips

- Use brown bottles, kegs or cans to store beer
- Careful to keep carboys and yeast starters (if primed with hops) out of light
- Keep hops out of sunlight during storage