

Boiling & Fermenting

Kunming Homebrewing Society December 2014

Milled grain --> Mash --> Sparge --> **Boil** --> **Ferment** --> Drink!

Why do we boil the wort?

- Sterilisation (through temperature and antibacterial hop constituents)
- Cease enzyme activity, destruct proteins
- Precipitation of undesirables - proteins, polypeptides, polyphenols, tannins
- Evaporation of undesirables- sulphur compounds like DMS is produced from heating malts - don't cover your boil!
- Solubilise and isomerise hops - rearranging hop acid molecules so that they dissolve into the wort - the longer and more vigorous the boil, the more this happens; hops add flavour, aroma, and help with sanitisation
- Wort concentration - sparging dilutes the wort, boiling re-concentrates it
- Colour development - sugars are caramelised
- Adding other flavours, e.g. fruits, spices
- Lowering the pH by 0.2-0.3 by the precipitation of calcium phosphate - a lower pH (~5.3) helps with most of the above

What is the hot break?

At the start of the boil you may see a foam buildup on the surface - this is the proteins coagulating due to the rolling action of the wort. When the clumps get heavy enough, they will sink to the bottom. These proteins affect the utilisation of hops so wait until **after** the hot break and *then* start your timer and add your hops. When you draw off the wort into your fermenter, leave this cloudy hot break material behind.

What next?

Cool the wort **quickly**! You want to be able to pitch yeast into your sterile wort as quickly as possible so that alcohol can be produced to keep the wort sterile, and hot wort will kill your yeast - they are fussy about temperature! Not only that, cooling the wort quickly will also precipitate more undesirable proteins - this is called the *cold break*. Keep your kettle covered while cooling to protect against airborne bacteria.

Transferring the Wort and Taking a Reading

Everything that touches the wort after the boil **must** be sanitised! Remember when transferring the wort to your fermenter to take a gravity reading. This will tell you how much fermentable sugar is in your wort for the yeast to convert to alcohol. You will need to know the *original gravity* reading to calculate the final alcohol percentage of your beer. The *original gravity* reading will also tell you your efficiency - how well you've extracted the sugars from your grains.

Pitching the Yeast

Before you add the yeast, your wort should be oxygenated so that the yeasties can breath and thrive. You can do this by either splashing your wort or injecting pure oxygen.

The yeast you add can be liquid, dried, or rehydrated. If adding liquid or rehydrated yeast, it's best that it's at the same temperature as your wort at the time of pitching - yeast don't like temperature shocks. If you don't see any bubbling, foaming, or churning after 12-24 hours, you may need to pitch more (maybe other?) yeast.

You want to keep your fermenter in a cool, dark place - light can impact the flavour of the beer - with a stable temperature.

The fermentation temperature depends on the yeast. Higher fermentation temperatures will produce more fruity ester flavours which may or may not be desirable. Lower temperatures will produce more cleaner-tasting beers. Generally you want to ferment ales between 15-22°, lagers between 5-10°. There are various ways to control/maintain fermentation temperature that you may need to employ in the summer/winter months.

After 1 or 2 days, a thick layer of foam will form at the top of the fermenter - this is called *Krausen*. This is a combination of yeast and wort proteins that will sink to the bottom after 3-5 days.

Fermentation produces alcohol, phenols, carbon-dioxide and some other stuff. You will need an **airlock** to allow the CO₂ to escape, otherwise your fermenter could explode or the lid/cap/bung might pop off. If your fermenter is very full or your wort was very sweet, excess *krausen* might need to escape - in this case you should attach a **blow off tube** than runs from your fermenter into a bucket of sanitiser solution; this can be replaced with an airlock after the *krausen* has sunk to the bottom.

Primary Fermentation

Primary fermentation will convert most of the fermentable sugars to alcohol and may be finished as quickly as 48 hours. We leave it to ferment longer though because the yeast will continue to eat other undesirable stuff, including some that it produces itself. We usually leave the beer in the fermenter for 8 to 15 days, but longer won't hurt. If you leave it for 6 months or so, the yeast will start to die and the living yeast will eat the dead, resulting in nasty off flavours.

You know when primary fermentation is complete when the airlock basically stops bubbling - less than 1 bubble every 2 minutes? or when a gravity reading has dropped to 0.010-0.016. Do not be tempted to open your primary fermenter until you're confident that primary fermentation is complete to prevent risk of infection and oxidation.

Secondary Fermentation

Some brewers like to transfer the beer from the primary fermenter to a secondary fermenter where it can be left for anything from 2 weeks to a year. Doing this helps to clear the beer by separating from the trub (proteins, hop material, yeast cake, etc. at the bottom of the primary fermenter) and allowing any residual material to slowly precipitate out. It's also a good way to allow the beer to age and for flavours to develop and mellow out, which is suitable for certain heavier/maltier/less hoppy styles.