

Homebrewing for Hackers

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What to expect?

- Here to share our interests with the community
- A break from the technical stuff
- Honestly, we are just as surprised as you are that this talk got accepted...
- Sorry no zero days...
 - You would think ;)

Zero Day: Hacking Derbycon Talk Abstracts

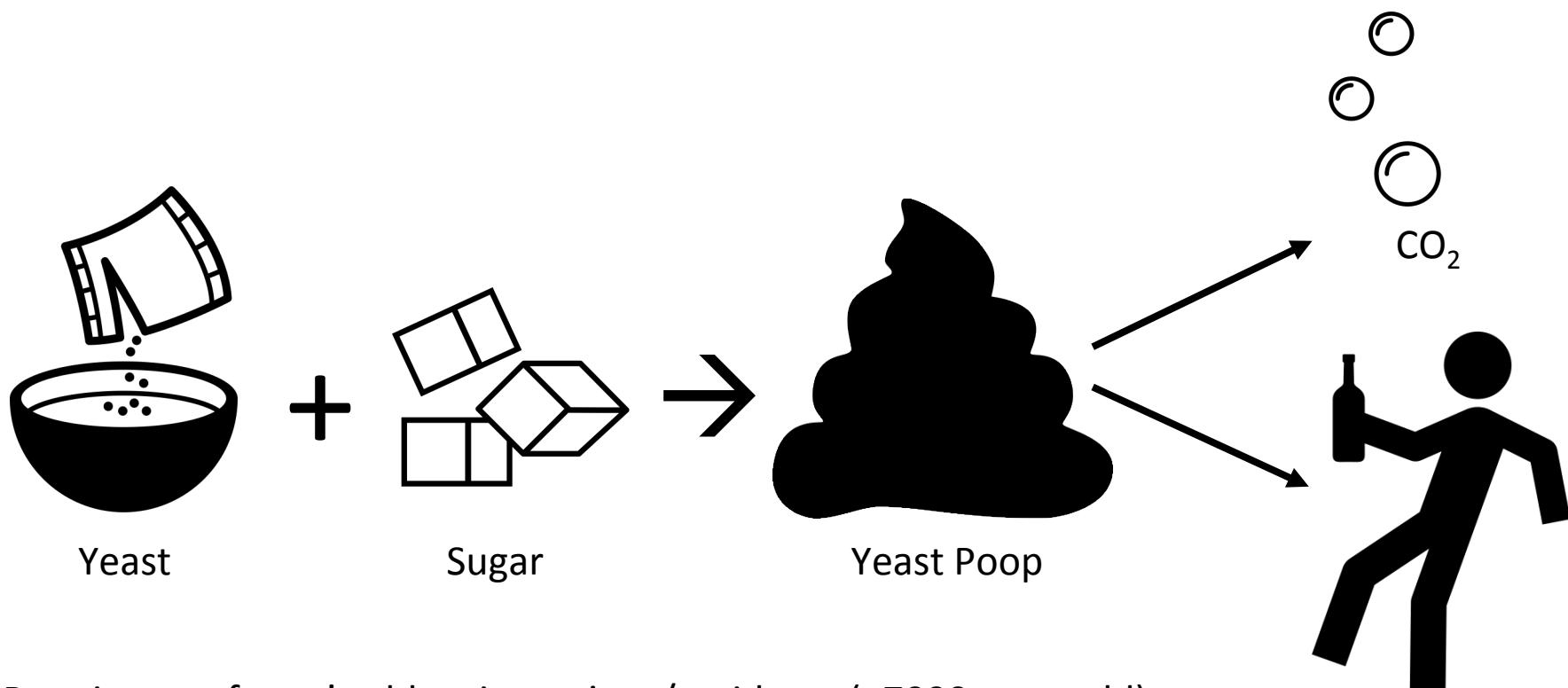
- Tell people you will give them beer for attending
- Name drop *int 0x80*
 - *Hey int 0x80 we just met you and this is crazy, but here's our talk, rap for us maybe?*
- Spend time thinking about *all* parts of your submission
 - Outline section is important too!
 - Here's ours:
<https://www.notehub.org/2015/9/20/derbycon-50-homebrewing-for-hackers-talk>
- Don't rule out stable talks! Less competition?
- Demo something
- Better yet, open source something you demo
- Give out free stuff ☺
- Use Unicode like a悬浮的老板 (levitating boss)
- Say “yes” to Derbycon hugs (regardless if you want them)
- Don't be shy, just submit a talk and see what happens

Talk Overview

1. Learn to make booze
2. History and legal fun
3. BrewLog project



Beer Chemistry 101



Beer is one of man's oldest inventions/accidents (~7000 years old)

Making booze is easy, what's left is to make it taste good...

Alcohol

Disclaimer

- We are not beer experts! We are just hobbyists.
- Lots of people have lots of opinions on best practices, many people online disagree fiercely
- Always room to improve, probably better ways of doing things
- Here's what we've been doing lately...

Step 0 – Open a beer and get organized

Bonus points
for brewing
with a friend!



Step 0 – Open a beer and get organized

- Gather any equipment you might need
- Good beer starts with good ingredients
 - Time to visit your Local Homebrew Store (LHS)!
- Extract kits are easy and make great beer
 - All grain kits will require more equipment
 - Brew in a Bag (BIAB)

Step 0 – Extract Kit Contents

Extract kit contents:

- Instructions
- Crushed grains
 - Barley
 - Wheat
 - Oats, Corn, Rye, etc.
- Liquid Malt Extract (LME)
- Dry Malt Extract (DME)
- Hops (bittering and aromatic)
- Priming sugar
 - Not used till later

Step 1 – Sanitization!

- Make sure your equipment is clean!
- Don't use soap, it can ruin the head on your beer. Use a chemical sanitizer. Star San is awesome because it's a no rinse solution.
- Don't use abrasive cleaning pads, they may leave scratches that could harbor bacteria in the future.

Step 1 – Sanitization!

- Anything that comes in contact with the beer after the boil step must be sanitized.
- You want your chosen strain of yeast to win, not something from the wild (it may make the beer taste skunky).
- **Sanitization is the most important step for good beer!**



Step 1 – Sanitization!

- **Protip:** If you ever end up getting sucked into a time vortex and end up having to live in the middle ages, don't drink the water, you are probably safer drinking beer or wine...
 - Why???



Go home Doctor, you're drunk...

Step 2 – Steeping the Grains

- Fill the pot with good tasting water (avoid adding chlorine)
 - 5 gallon batch: 2-3 gallons
 - 1 gallon batch use 1 gallon of water
 - More water results in better hop utilization and less darkening of the wort, which will make better beer
 - Some water will evaporate off, but also need to be careful of boil overs
- Heat the water to around 155°F (not boiling!)
- While you wait for the water to boil, make the smart person read the instructions!
- **Protip:** Create a timeline and label the hops in the order they will be added
 - Ben messed up the hop ordering last time because he skipped this step 😞

Step 2 – Steeping the Grains

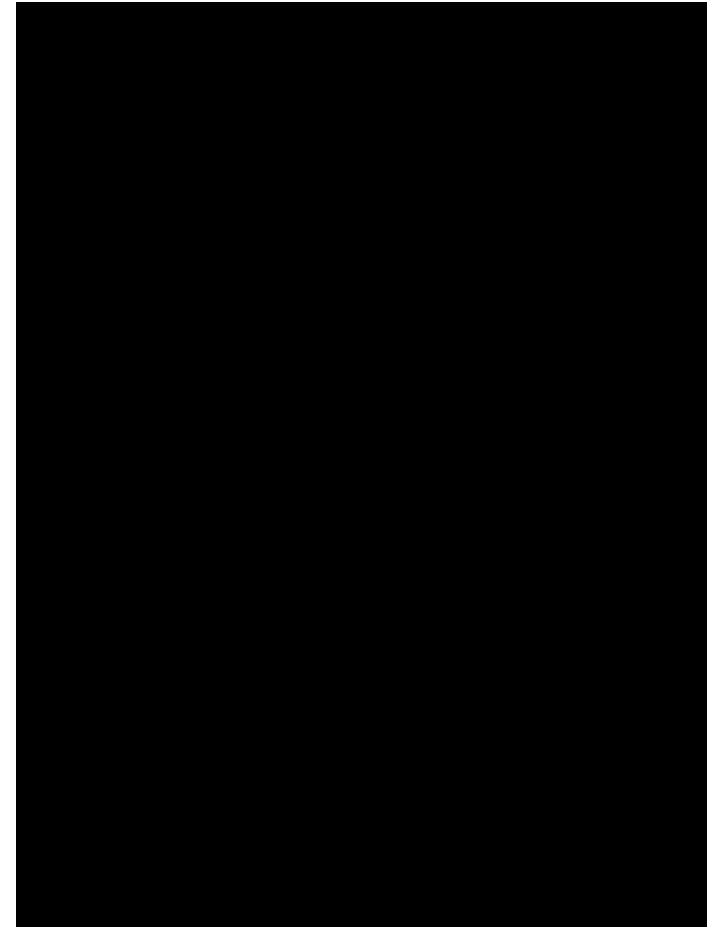
- Pour your grains into the muslin grain bag

Step 2 – Steeping the Grains

- Tie off your grain bag to the side of the pot (so you can easily take it out later).
- Steep grains for 15-30 minutes @ 155°F
- Now you basically have tea. Give it a taste!

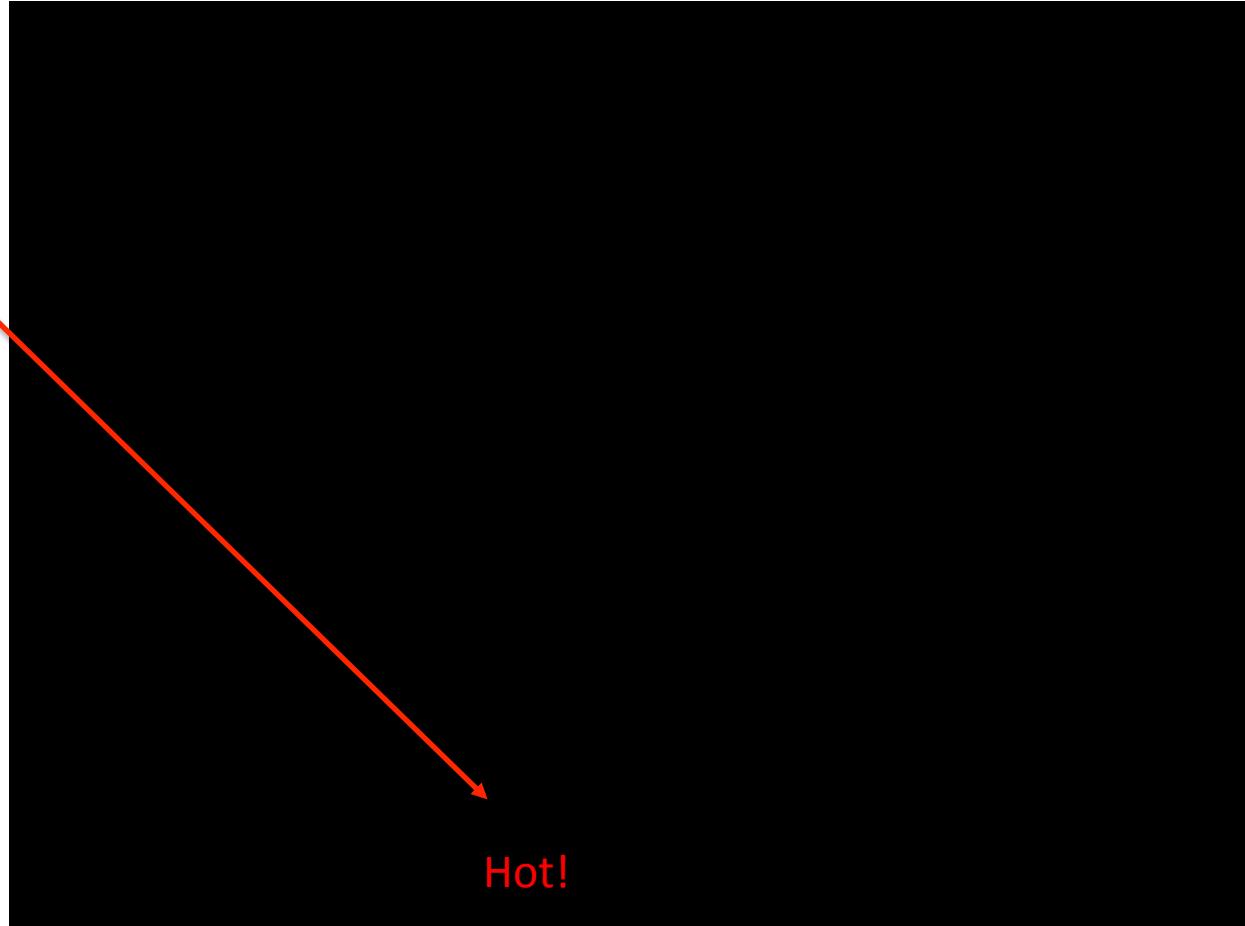
Step 4 – The Boil

- Remove the grain bag and discard
- Bring your pot to a boil
- Meanwhile if you have any LME let it warm up in some hot water



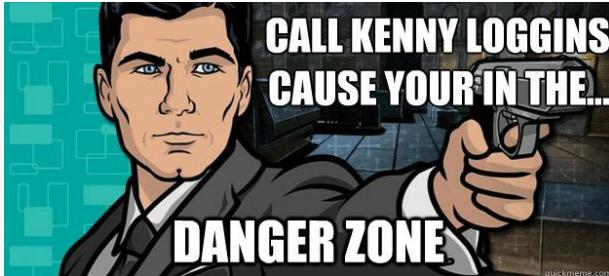
Step 4 – The Boil

- As soon as the pot reaches a boil, remove it from the heat!
- Add your LME and DME
 - Stir well to avoid scorching on the bottom of the pot
 - Stir until fully dissolved
- You now have wort!



Step 4 – The Boil

- Return pot to heat, and bring wort to a boil
- Watch out for boilovers!
 - Very messy and hard to clean...
 - Trust us...
- Boil for 1 hour



Step 4 – The Boil

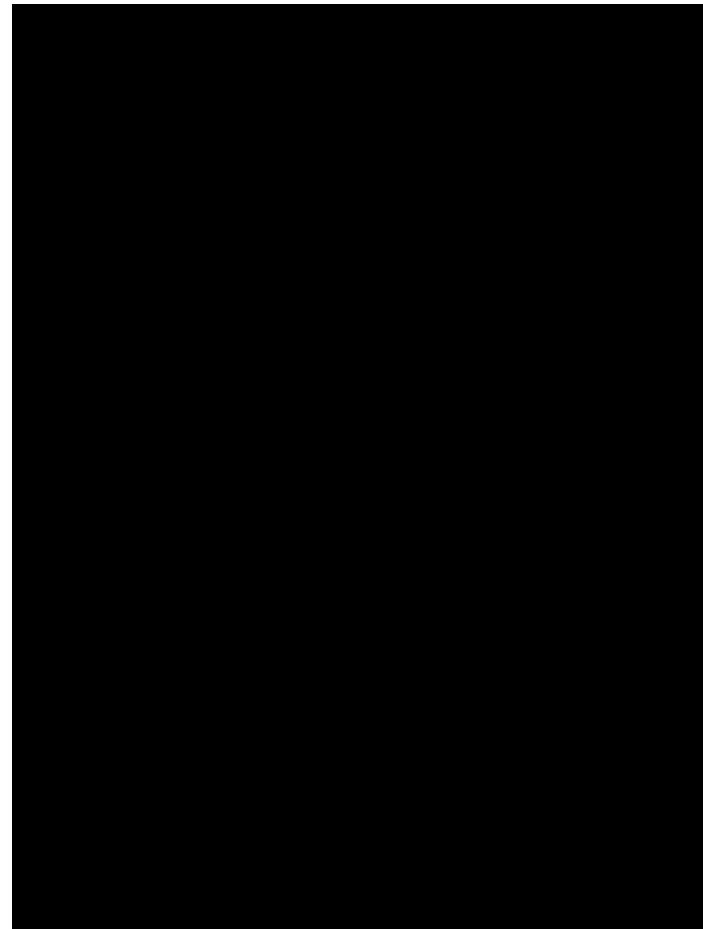
- Add your hops
 - Bittering at ~45 minutes remaining in the boil
 - Aromatic ~10 minutes remaining in the boil
- A food scale is handy for measuring

Step 5 – Cooling and Aerating Wort

- Cool your wort as fast as possible to below 80°F
 - Using a wort chiller, or
 - A sink full of ice
- Remember anything that comes into contact with wort at this point must be sanitized!

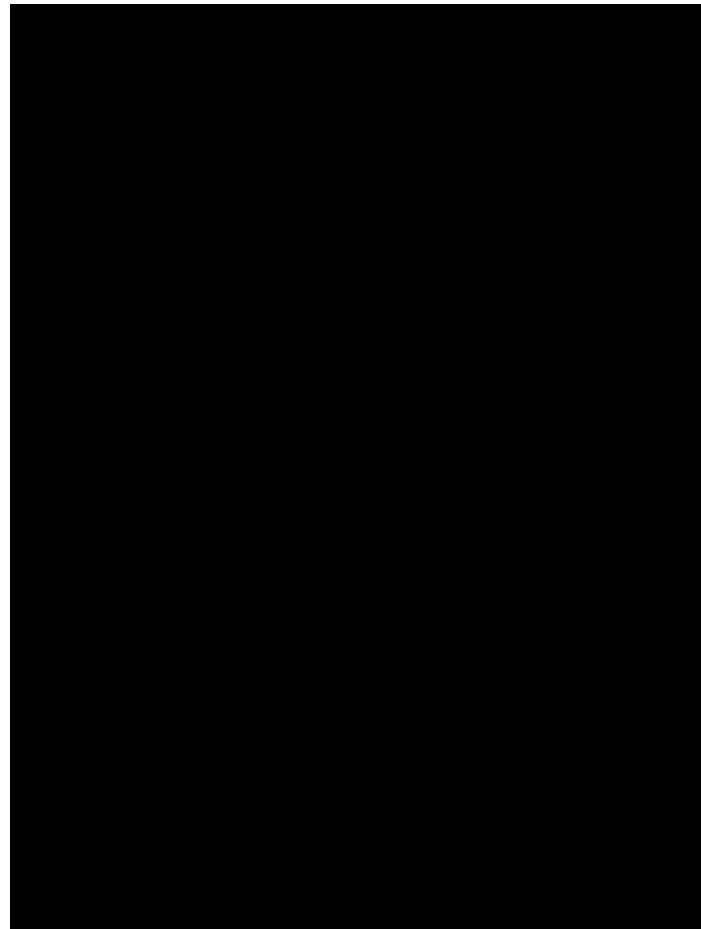
Step 5 – Cooling and Aerating Wort

- Aerate the wort
 - Pouring between two clean buckets, or
 - Stirring vigorously, or
 - Using a tank of pure oxygen, or
 - Using an aeration stone
- Pour the aerated wort into the primary fermenter



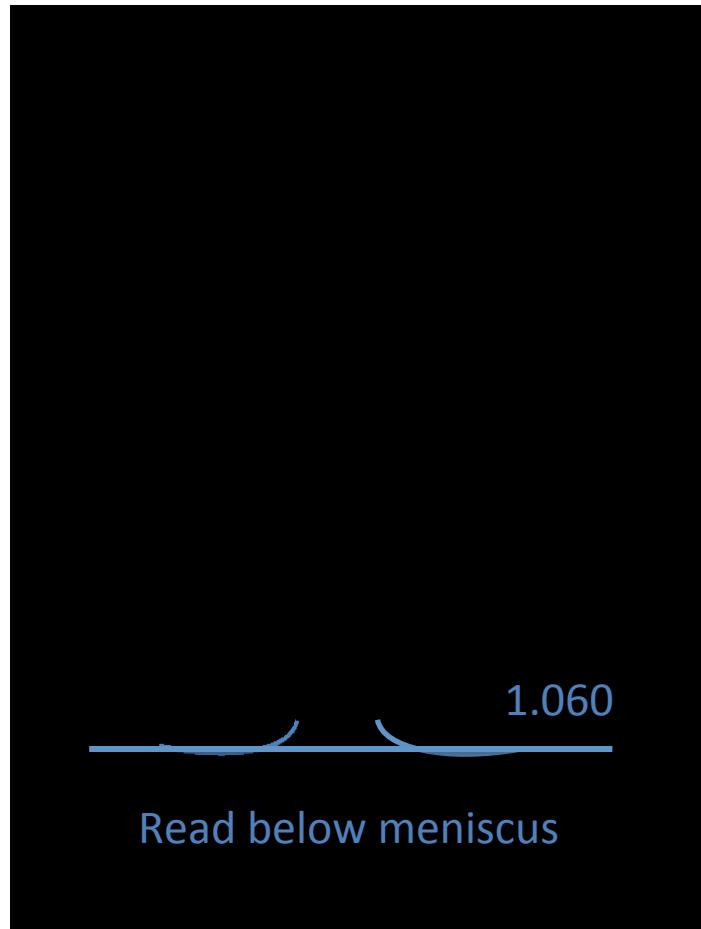
Step 5 – Cooling and Aerating Wort

- Using sterile water, top off the wort to just under the target volume
 - Don't add too much water!



Step 5 – Cooling and Aerating Wort

- Remove a sample and take a hydrometer reading
 - Measuring how much sugar is in our wort
- Add small increments of water to fermenter until target starting gravity, aka original gravity (OG), is reached



Step 6 – Pitching the Yeast

- Pitch the yeast
 - Pour in a yeast starter, or
 - Add yeast started in a small bowl of sterile water for 15 minutes, or
 - Simply dumping in the contents of the dry yeast packet into fermenter
- No yeast = No beer



Step 6 – Pitching the Yeast

- Seal fermenter with an airlock
 - Fermenter is not rated for any pressure, so need to release CO₂!
- There is a potential the airlock liquid may accidentally get into the fermenter, so use:
 - Star San, or
 - Clear grain alcohol

Step 7 – Fermentation

- Keep the fermenter in a dark area between 65-72°F
- Signs of active fermentation will be visible within the next few hours to a few days depending on the yeast
- Primary fermentation completes in 7-14 days
 - Look for no visible signs of fermentation
 - Stable hydrometer readings over a few days
- You now have (flat) beer!



Step 8 – Secondary Fermentation

- Avoid aerating the beer after fermentation!
 - May create a cardboard or vinegary taste ☹
- Optional re-racking to secondary fermenter
 - Use a siphon to transfer (rack) the beer to a secondary fermentation vessel for aging
 - Leave the “trub” and “krausen” behind
 - During conditioning the yeast will eat the more complex sugars and harsh flavors will smooth out
 - 2 weeks to 6 months or more
- Optional secondary additions
 - Oaking
 - Fortification
 - Fruit additions
 - Dry Hopping



Step 8 – Secondary Fermentation

- Take another hydrometer reading to measure Final Gravity (FG)
- Use OG and FG to compute Alcohol by Volume (ABV)
- Basic Formula
 - $ABV = (OG - FG) * 131.25$
- Alternate Formula
 - $ABV = (76.08 * (OG - FG) / (1.775 - OG)) * (FG / 0.794)$
 - More accurate for higher gravity beers
 - Difference is within a tenth of the basic formula
 - Relationship between gravity and ABV is not perfectly linear, so these equations are just approximates

Step 9 – Carbonating

- Bottling
 - Natural carbonation using yeast + priming sugar (2-3 weeks)
 - Cheaper if you have the bottles laying around (5 gallons = ~35-45 bottles)
 - Can't recap twist-offs
 - More work to sanitize
 - Chemical sanitizer, dishwasher, oven
- Kegging
 - Forced carbonation using compressed CO₂ (1-3 weeks)
 - Less work than bottling, no risk of “bottle bombs” from too much sugar
 - Beer on tap!



Step 10 – Rinse and Repeat

- Save your bottles
- Rinse
- Brew again!



Soda, Wine, Spirits and More!

- Root Beer
- Wine, Mead (honey wine)
 - Actually less ingredients than beer!
 - More need to manage PH and health of the yeast
- ~~Distilled Spirits~~

Prohibition – The Nobel Experiment

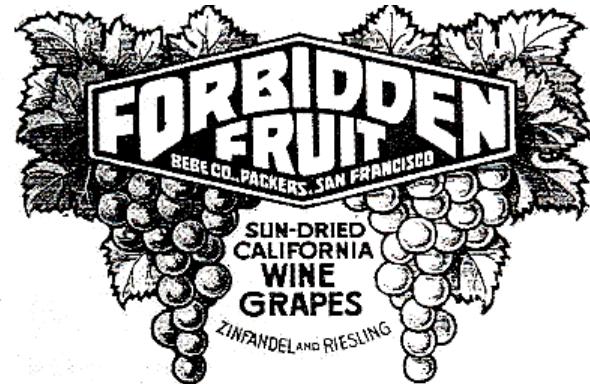
- Sentiment was that drinking was a nationwide scourge
 - Intense lobbying by the Anti-Saloon League, Women's Christian Temperance Union, other "dry" advocates
- Congress ratified the Eighteenth Amendment on January 16, 1920
 - Prohibition began on January 17, 1920
 - Banned the "manufacture, sale or transportation of intoxicating liquors"
 - Not actually illegal to drink...
 - Allowed for scientific, industrial, religious uses
- Most thought it was just for "hard" liquors
 - Volstead Act was created to enforce prohibition
 - Brewing .5% ABV or higher was made illegal



Prohibition – Getting Creative

What do you sell to survive as an alcohol business during prohibition?

- Anheuser-Busch
 - Soft Drinks (same equipment to make root beer!)
 - Brewer's Yeast, Malt Extracts
- Wine Vineyards
 - “raisin cakes” with warnings
 - Do not let raisins soak in water
 - Do not let juice sit in a jug for 21 days
 - Otherwise fermentation may occur



Directions for Making Three Gallons

S^{OAK} five pounds of California Dried Wine Grapes in cold water. After 12 hours run the liquid off and keep for later use. Crush the grapes in a small mill or meat-chopper. The pulp is then soaked in water and pressed. Repeat this once more.

Put all the juices in a three-gallon crock, fill with water to the top, add two pounds of sugar and let ferment at a temperature of 55° to 65° Fahrenheit for one week.

Skim off and siphon into a cask or 3 gallon demijohn.

Cork with a vent hole bung, (a bung with a hole bored through, allowing the excess gas to escape, at the same time preventing the entrance of air), and keep fifteen days for after-fermentation.

Add the beaten whites of two eggs for clarifying.

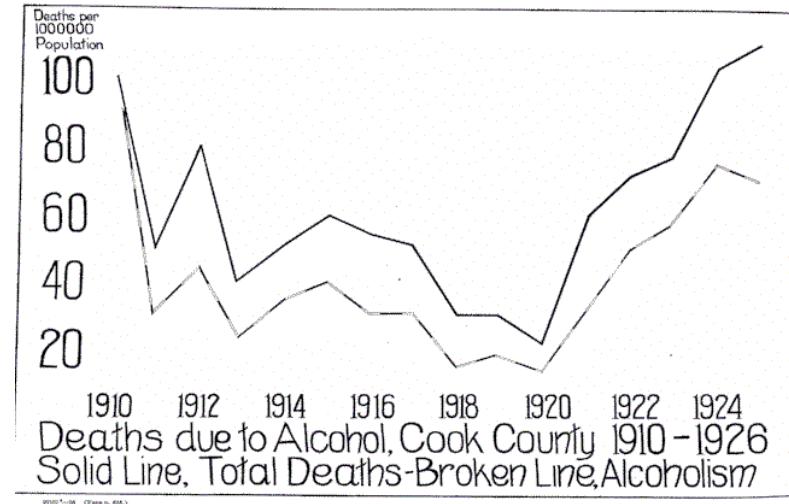
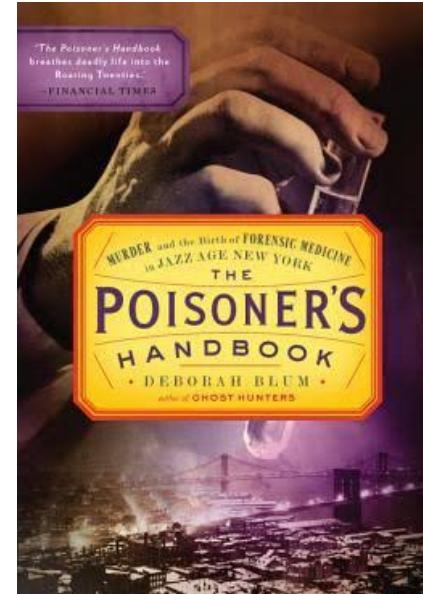
Bottle, then immerse bottles with the mouth only projecting in a large vessel of water. Loosen the corks and heat the water to a uniform temperature of 180° Fahrenheit. Then remove the bottles, cork and seal tightly and place in an inverted position in the cellar.

During prohibition instructions were provided on 5x7 cards like the one above.

Prohibition – Dangers

Will drinking homebrew make me go blind?

- Wood alcohol (methanol) is incredibly toxic to humans (metabolizes into formaldehyde)
 - Made by distilling wood
 - Tastes just like alcohol (ethanol)
 - Used as a denaturing agent for industrial ethanol
 - Was produced and sold underground during the prohibition as booze
- Chemists game of denaturing and renaturing industrial alcohol
 - If you were wealthy you drank with the chemists
- During prohibition there was only an underground market for the “hard stuff”
 - If you drank something bad, you drank a lot of it...
 - Drinking rose to record levels during prohibition (including women and children)



Homebrewing Today

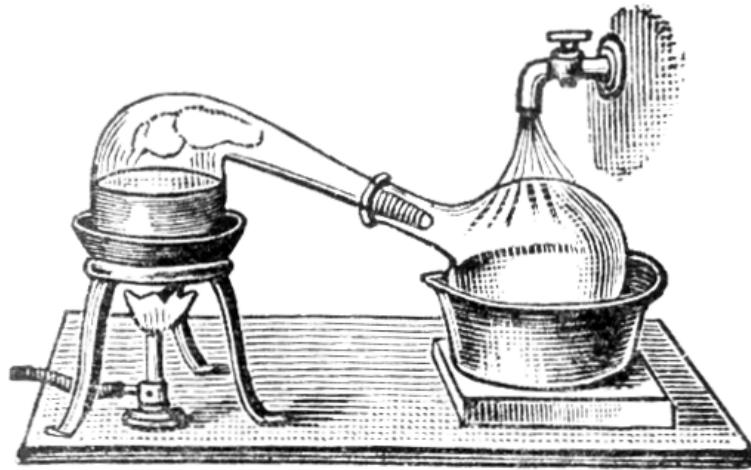
- Brewing is legal in all 50 states!
 - State laws vary widely
 - Alabama and Mississippi legalized homebrewing in 2013
 - Limit 100 gallons per year per person, up to 200 gallons per household
 - Homebrew cannot be sold
- Need a license to own or operate distillation equipment
 - Subject to taxation
 - Apparently not too hard to get a license...



- 21st Amendment (1933): Repeal Prohibition
- 20th Amendment (1933): Presidential term ends Jan.
- 19th Amendment (1920): Women Vote
- 18th Amendment (1919): Prohibition

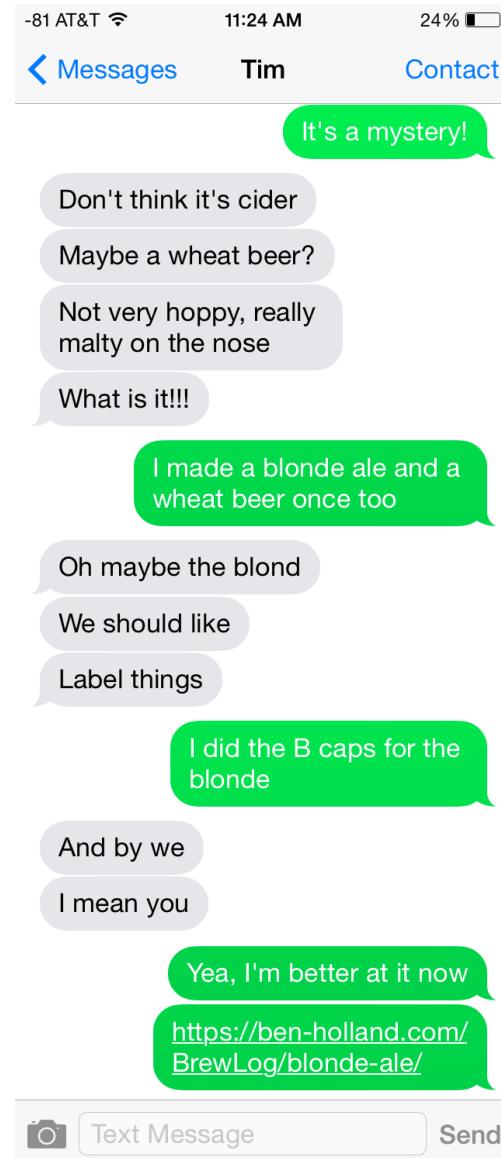
Legal Challenge

- If you can't legally “distill” alcohol, how else could you create hard liquor?
 - Not legal advice! You could probably still get in trouble...
 - <https://homebrew.stackexchange.com/questions/2813/distillation-legality>
 - Freeze Concentration ~15-90%
 - Artificial Yeast Selection ~20-25%



BrewLog

- “We need a better system”
- BrewLog
 - Publicly log homebrew measurements
 - Automatically computes alcohol content
 - Version controlled (git)
 - Free web hosting (Github Pages)
 - Deploys in ~5 minutes (just fork and edit project)
 - Simple to edit (Markdown)
 - Clean/simple theme (Jekyll-Now)
 - Supports custom domains (CNAME records)
 - Customizable



BrewLog

Ben's Brew Log - A public homebrew log with version control! <https://ben-holland.com/BrewLog/>

Brew Log **Brewmaster**

Sabotage Saison

Brewed on September 7, 2015

Ingredients

Specialty grains, 6.3 lbs. Gold liquid malt extract and 1 lb. Gold dry malt extract, .5 oz. Calypso hops, 1.5 oz. Equinox hops, Lallemand...

[READ MORE](#)

Premo Pruno

Estimated ABV: 11.55 %
Brewed on July 27, 2015

Ingredients

~6 oz. frozen strawberries, 12 oz. frozen blueberries, ~18 oz. frozen blackberries, 24 oz. frozen raspberries, 24 oz. frozen cranberries, ~34.5 oz. of [READ MORE](#)

Strawberry Dessert Wine

Estimated ABV: 15.75 %
Brewed on June 19, 2015

Ingredients

23.3 lbs. processed and mashed strawberries, 12 lbs. rock candy sugar, 1/4 teaspoon sodium metabisulfite, 5 teaspoons pectic enzymes, 5 teaspoons yeast nutrient, 2...

[READ MORE](#)

Blonde Ale - Ben's Brew Log - A public homebrew log with version control! <https://ben-holland.com/BrewLog/blonde-ale/>

Brew Log **Brewmaster**

Blonde Ale

Brew Date	March 1, 2014
Yield	5 gallons
Original Gravity (OG)	1.05
Final Gravity (FG)	1.012
Estimated ABV*	4.9875 %

Ingredients

3 lbs. Wheat DME, 2 lbs. Pilsen DME, 8 oz. Caramel 10L, 8 oz. Flaked Wheat, 4 oz. Caravelenne malt, 1 oz. Willamette hops (bittering), Safbrew T-58 Dry Yeast

Recipe

This was an extract kit from Midwest Homebrewing Supply. The recipe is available online [here](#).

Brew Notes

Used a brew bag for hops. Left in primary for 4-5 weeks and bottled without a secondary fermentation.

Tasting Notes

I was hoping for something similar to Peace Tree Brewing's Blonde Fatale and I think it came pretty close.

0 Comments [BrewLog](#) [Login](#) [Sort by Best](#)

[Recommend](#) [Share](#) Start the discussion...

Be the first to comment.

Deploy your own BrewLog: <https://github.com/benholla/BrewLog>

Questions?

- Thank you!
- Hacking + Brewing = Win!?
 - BruCon
 - Thotcon

Slides: ben-holland.com/publications
amberaldrich.com/publications