

Homebrewing

1. Introduction

Homebrewing beer is a fun exercise that has exploded in popularity recently. You don't need to be 21 to buy homebrew supplies, and in all honesty, it's probably a cheaper alternative than buying a good fake ID (not that I would endorse such a thing). Homebrewing can be a really fun experience and highly rewarding as you tweak a recipe to make a beer exactly how you like it. It's also a really good way to learn about beer and explore unique tastes.

I suggest you try a lot of different types of beers before engaging in this. People that like only "Bud Light," "Miller Light," or the other big names probably won't appreciate beers that fall out of the "pilsner" category. There are light beers that are heavy, dark beers that are light (Guinness is actually light, folks), beers made with wheat, beers that are intentionally bitter, and, my favorite, a specific style of beer that is still mostly brewed by Belgian monks (no lie).

Personally, I get very much into the science of beer making. It really is both an art and a science at the same time, which probably contributes to why homebrewing seems to be especially popular among engineers. This document is not intended to explain how to make the "perfect beer" or even describe what a "good one" is. Everybody has their own tastes and mine is no substitute for your own. I wish there was a way to transport knowledge of how different hops & malt come out smelling or tasting, but unfortunately I am bound to keyboard, which is a poor method of transfer of such information; experience is the best.

For the people that may be pessimistic from the length of this document, here's some (approximate) statistics that may make or break your desire to do this:

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|---|--------------------------------|
| Initial investment cost: | \$70-120 (one time) |
| Batch yield: | 5 gal (~ 2 cases = 48 beers) |
| Batch cost: | \$20-40 |
| Price per beer (less the initial investment): | \$.50-\$1 |
| Time of work invested per batch: | 2-3 hours (but it's easy work) |

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May 27, 2007

2. Equipment

The nearest homebrew supply store probably has most of this equipment. To find the nearest homebrew supply store, check out <http://www.brew-monkey.com/links/homebrewshoplinks.php> or search google for “homebrew supplies” and add your city to the search request. Chances are there's one nearby. Without further ado, here are the supplies you'll need.

1. Plastic bucket(s) with an airtight cap and a 5 gallon mark (you can mark yourself). Generally one that holds 6.5 gallons is best. [hardware store or a homebrew supply store]
2. Glass carboy (optional, used for secondary fermentation) [homebrew supply store]
3. Bottle capper [homebrew supply store]
4. Thermometer that reads up to 200+ degrees Fahrenheit [grocery store or homebrew supply store]
5. Plastic tubing for siphoning (¼” inner tube diameter, 3+ feet long) [hardware store or a homebrew supply store]
6. Airlock [homebrew supply store]
7. Hydrometer [homebrew supply store]
8. Pot that holds 20+ quarts [grocery store, Target/Wal-Mart, or a homebrew supply store]

All told, this will probably run you between \$70 & \$120 (the glass carboy costs \$20-\$25). If you buy the plastic buckets from a homebrew store, you can get one with a spout to fill the bottles when you're done fermenting and one with the hole precut for the airlock. Unless you have a really tight budget and want to save every last dollar, I recommend just buying it all from a homebrew store rather with the exception of the thermometer and the boil pot. It saves a lot of hassle.

3. Beer Ingredients

Beer has 4 main ingredients:

1. Water – lots of it. Each 5 gallon batch will need at least 4.5 gallons of water (more, if you use crushed grain).
2. Malted grains – Usually malted barley is used, but occasionally (in beers like hefeweizens), wheat is used instead. Between 4 and 10 lbs of malted grain per 5 gallon batch is not atypical for a 5 gallon batch. The main extract from the malt is sugar. There are light malts, dark malts, chocolate malts, and so forth, each providing a different flavor.
3. Hops – Added in small amounts (typically between 1 and 4 oz), these add stability to beer as well as adding smell, bitterness, and some other flavors. There are some beers (such as India Pale Ales) that add a large amount of hops to the beer. Lots of people don't like these because they feel that the bitterness is overwhelming. There are a number of different types of hops, each giving different flavors.
4. Yeast – These are a type of fungi that make the alcohol found in beer. When there is an absence of oxygen (as when you put everything in an airtight fermentation container), yeast reacts with the sugar from the malt to create alcohol. Thus, higher sugar content (more malt) yields higher alcohol content. Different strains of yeast (there are over 1000 of them), again, provide different flavors.

Further, a lot of people add some other standard ingredients. Irish moss is often used to make beer more clear while fruits are often used as flavoring in beers. Spiced beers may use coriander, mace, chocolate, and other ingredients to flavor the beer. As you can see, with all the different types and proportions of each of these ingredients, unique tasting/smelling beers can be created.

With the exception of the water, all of these ingredients should be purchased at your homebrew supply store. They should crush your grain for you, but even if they don't, it's easy to grind it.

4. Process Overview

I know it seems overwhelming already, but I promise that it's not as complicated as it may seem. Here, I outline the basic process by which beer is created. Don't let the length of this fool you into thinking it's hard. The length is just for clarity. I recommend reading over the entire process at least once before just jumping into it. These instructions are for brewing an ale. If you want to brew a lager, read *additional note #11* (steps 8 and 11 will be different).

- 1. Clean clean clean.** Clean the buckets, the empty bottles you plan on using, the hydrometer, a large stirring device, your thermometer, the tubing, and the pot. They make a powder called “no rinse clenser” for this purpose.
2. Extract sugar/ flavor from crushed grains. Basically this is done the same way as you make tea. Add grains in a large grain bag to a pot containing 2-3 gallons of water slowly bring it up to a boil. As the water gets hotter, the sugars and flavors of the malt will be extracted into the water. Once the water gets up to about 150 degrees Fahrenheit, you usually want to leave grains “steeping” at this temperature for about 30 minutes. After this, remove the grain bag from the pot and bring the water up to boiling.
3. Add any liquid extract grain. You can buy malt extract at most homebrew supply stores and generally it's a lot cheaper than the grain version. Unfortunately, they typically only carry general light/dark malt extract. Thus, you need to buy the special malts (chocolate malt, etc) as a crushed grain and extract them in step 2.
- 4. Let the “wort” boil for about 60 minutes. BE VERY CAREFUL! IT HAS A TENDANCY TO TRY TO BOIL OVER (especially at the beginning of the boil)! You will probably have to lift your pot up off the burner a few times as it looks close to boiling over. Stir it occasionally to make sure nothing settles at the bottom. Any hops you add to the entire 60 minutes will make the beer more bitter. Hence they are called “bittering hops.”**
5. At 15-30 minutes from the end of the boil, any hops you add will be incorporated into the flavor of the beer (generally 0.5-2 oz are added). Hence, hops you add at this time are called “flavoring hops.”
6. At 5-15 minutes from the end of the boil, mostly only the aroma from any hops you add will be incorporated into the beer. Hence, hops you add at this time are called “aroma hops.”
7. After the boil is over, rapidly cool the wort to ~80 degrees Fahrenheit. This is to ensure the yeast isn't killed when you add it. The best way I've found to do this is transport the pot into a bathtub of ice water and stir the wort to cool it.
8. As you're cooling the wort, if you have dehydrated/ packaged yeast, add it warm (~70 degrees Fahrenheit) water. You should leave about 10-15 minutes to rehydrate the yeast before adding it in step 9.
9. Put both the wort and the yeast in a bucket with a 5 gallon mark and an airlock in the cap. Fill to the 5 gallon mark with water. Mix well. Take a reading from the hydrometer: this is your starting gravity.
- 10. Now, fermentation begins!** Cap the bucket, add water to the airlock, and put the airlock on the bucket. The airlock is to ensure no oxygen gets into the bucket while simultaneously maintaining a constant pressure inside the bucket. If there were no airlock, the cap may explode off the top from the expansion of carbon dioxide inside.
11. Leave the beer in a place that stays 68-75 degrees Fahrenheit for 5-7 days. You should notice bubbles escaping from the airlock. This is carbon dioxide being released and alcohol being created. Once the bubbles stop, fermentation is over.
12. If you have a secondary fermenter (glass carboy), transport the beer into it by siphoning it over. This should leave some yeast or hops in the plastic bucket. You can leave it sitting in the secondary fermenter for several weeks (between 2 and 6) to clear up the beer.. If you don't have a secondary fermenter, just go straight to step 13.
- 13. Bottle the beer!** Siphon the beer into whatever bucket has the spout on it. Mix in ~3/4 cup of corn sugar, which will create the carbonation in the bottled beer. Take a reading with the hydrometer: this is your final gravity. Use the spout to add beer to empty/clean bottles. 5 gallons should make ~50 bottles; cap each bottle with the bottle capper.
14. Let sit for a minimum of 2 weeks. Some beers age to their best after 4 weeks while others take a full 2-3 months to develop. In general, the longer the beer sits, the more alcoholic and carbonated it will get.
- 15. Enjoy your beer.**

The cooking takes a total of about 90 minutes while setup & cleanup takes an additional 30.

5. Additional Notes

1. Some homebrew stores have large containers of liquid malt extract that they sell for reduced price. If your recipe calls for light or dark grain malt, it's usually cheaper to get the liquid malt extract (assuming they have the same type that you're looking for).
2. You can buy sets of preselected ingredient packs (including the malt, hops, yeast, and any spices) for typically \$20-\$35. They also typically have instructions included. I recommend you start with one of these to get a feel for how the process works. These taste fine, but they're also typically not very complex.
3. More malt = more sugar = more alcohol in the beer.
4. Secondary fermentation is basically a process where you let eliminate dead yeast from the batch, which sits at the bottom after primary fermentation. This is done by moving the beer from the primary fermenter (usually a plastic bucket) to the secondary fermenter (usually a large glass "carboy") via siphoning, thereby leaving the dead yeast behind (this process is known as "racking"). Leaving beer in the primary fermenter for too long creates bad tasting beer. By moving over everything except the dead yeast (and any solids you don't want) you create a more hospitable environment for the live yeast. Also, because most of the fermentation has stopped by the time you rack the beer over, you can add the final flavors that will come through. For example, hops added to the boil don't come out as much as those added to the secondary fermenter. This is why really hoppy beers (ESBs, IPAs, etc) typically add a second set of hops at the beginning of secondary fermentation.
5. Common spices & flavorings in beer: coriander, cinnamon, sweet orange peel, bitter orange peel, cardamom, mace, licorice, vanilla extract/vanilla beans, ginger, and anise. As a general rule, less than an ounce of these are added to a 5 gallon batch during the last 15 minutes of the boil, although occasionally vanilla extract may be used in 2-4 ounce quantities and added during secondary fermentation. There are always exceptions to the rule, but these are guidelines.
6. Irish moss is a seaweed that is often added to make the beer to give it more clarity.
7. Fermentation temperature is critical. Most beers ferment best around 70 degrees. Before you decide on a recipe, ensure you can keep the temperature correct.
8. As previously mentioned, there are many different strands of yeast. Each provide different flavors to the beer and also, some of them let you ferment at different temperatures. You can buy packets of "generic" dry yeast, which needs to be hydrated by suspending it in water for 10-15 minutes before adding it to the beer. I recommend using this (for the low price) before trying some unique yeasts.
9. For your first beers, find a recipe that's either all grain, grain with extract, or all extract (the ingredient packs in note #2 are all like this).
10. As an alternative to corn sugar, cane sugar, brown sugar, or honey can be used to carbonate the bottles. Cane sugar produces higher carbonation while the brown sugar/honey have more complex sugars that take longer to break down, and therefore take longer to carbonate your beer. Typically, corn sugar is used, but some people like the subtle taste more complex sugars produce.
11. Lagers are brewed at lower temperatures for longer times. Thus, lager yeast is needed. If you're antsy about jumping into a lot of changes, I recommend starting with an ale, which can be fermented around room temperature.
12. Like syrup, liquid malt extract pours easier if it is heated. If your recipe calls for some, place the container in hot water as you're steeping.

6. Resources

1. The Recipator [<http://hbd.org/recipient/>]: Contains thousands of recipes of all styles of beer. You can add your own recipes as you become better and start to explore new ideas.
2. How to Brew by John Palmer [<http://www.howtobrew.com>]: This is the most complete homebrew website I've seen. You can brew beer using this document, but if you really want to learn everything there is to learn about homebrewing, check out John Palmer's website.
3. Homebrewing Beer (Wikipedia) [http://en.wikipedia.org/wiki/Homebrewing_beer]: Good article to get started on reading about the homebrew process.
4. Homebrew How-to [http://www.homebrew.com/how_to/how_to.shtml]: Step-by-step how to homebrew beer.
5. BYO Magazine [<http://byo.com/>]: Magazine that specializes in homebrewing. I've never bought an issue, but their website is extremely informative, especially in regards to how different hops, grains, and yeasts smell and taste.