The Basics of Brewing Beer

Beer is a fantastic beverage, available in a wide selection of flavors and styles, but all beers share four common ingredients: Malt, Yeast, Hops, and Water.

Malt or malt extract provide the sugars necessary for the fermentation process. More malt equals more sugar. This in turn equals more alcoholic strength. While the majority of sugar in malt is fermentable, a small percentage, averaging 25% or so, is too complex for the yeast to consume or ferment. These residual unfermentable sugars remain in the beer to provide body and mouth feel. The unfermentable sugars counter the bitterness in the hops and provide balance in the finished beer. A balanced beer is not too sweet and not too bitter, but pleasing to the palate. There are two basic categories of malted barley: base grains and specialty grains. Base grains are loaded with the all the starch needed to make a beer, but it must be converted into sugar first through a process called mashing. Specialty grains have minimal to no starch remaining after malting, and are primarily used for color and flavor characteristics. These specialty malts provide a huge variety of colors and flavors, ranging from pale gold to orange or red, as well as from brown to very black. They can contribute flavors like caramel sweetness, toasty bread-like flavors, roasted notes, and even sharp burnt character.

Yeast is the heart of a beer. It is the living organism that turns wort into beer. Yeast is a fungus that consumes sugar as its food source, releasing by-products of alcohols and carbon dioxide. Fermentation vessels allow the CO2 gas to be vented, while the alcohols stay in the beer. The choice of yeast can be critical for some beer styles to get the flavors a brewer is trying to produce. Yeast falls into two basic categories: ale yeast and lager yeast. All yeast loves to ferment at warm temperatures as high as 80-90 F. Those high temps are only suitable for some Belgian styles of beers as at those high temperatures some fruity and phenolic character can come out. Most ales should ferment between 58-70 F. A good rule to remember is that the cooler fermentation temperature, the cleaner the flavor of the finished beer. Lager yeast is able to tolerate much colder temperatures than ale yeast, but they will also ferment at warm temperatures. However, this would typically produce undesirable flavors. Ideally a lager yeast would ferment from 50-56 F. Some can even continue to ferment in temperatures down into the low 40s.

Hops are the flowers harvested from a twining plant. They are dried, used fresh, or ground into a powder and pressed into pellets for better storage ability. Hops are added to the boil to give the beer bitterness, flavor, and aroma, providing the balance and distinctive character to beers. Hops also provide some spoilage protection because they are naturally antiseptic. There are two major components to hops: hard resins and volatile oils. The hard resin is not water soluble. It needs to be broken down so that the bitterness can be extracted. This is done by boiling them for an extended time, normally an hour. Over the course of the hour boil, the bitterness is extracted and will remain in the finished beer, while the volatile oils that make up the flavor and aromatic character of the hop are vaporized and boiled away. In order to get any hop flavor and aroma, hops need to be added later in the boil. The late addition hops are
not boiled for long enough to extract much bitterness, but just long enough to dissolve their oils and keep the flavor and aroma intact. Hops can also be added to the fermenter, a technique known as dry hopping.

**Water** is an important ingredient as it makes up the majority of the beer, in terms of volume. The mineral content of the water will change slightly the flavor of the beer. It is probably less important in malt extract beers than in all grain beers where starch conversion is affected. Generally speaking hard water is better for making dark beers and soft water is better for making lighter beers.

**Sanitation**

Proper sanitation is the most important thing that a homebrewer can do to ensure good beer. Sanitizers cut down on the bacterial load of surfaces, and help to eliminate wild yeasts. Bacteria and wild yeast can contaminate the wort and produce off-flavors that may ruin a perfectly good recipe. Using sanitizers all along the brewing process can help to ensure success in every batch of beer you make. There are several sanitizers available that are easy to use because they are classified as no-rinse formulas.

Easy Clean is an oxidizer that can be used to clean OR to sanitize. It will not do both at once. Easy Clean is an oxidizer, and releases active free oxygen to destroy microorganisms. However, the more soiling or dirt it contacts, the less effective it becomes. So, you can use Easy Clean to clean dirty equipment; but you must then mix a fresh batch of Easy Clean to sanitize equipment that is already physically clean. Easy Clean should not be saved and reused, as its sanitizing ability only lasts as long as the crystals are dissolving.

Iodophor is another class of sanitizer. Its main ingredient is iodine, which is really effective at destroying microorganisms. Iodophor, if mixed in the proper dilution, is a no-rinse type of sanitizer. The drawback of using iodine to sanitize is that it stains plastic surfaces orange. Typically we reserve Iodophor for sanitizing glass and stainless steel. Iodophor can be stored and reused if it is kept in a tightly sealed container. Iodine test strips are available to determine its concentration.

Star-San is an acid based sanitizer. It destroys microorganisms by exposing them to an extremely low pH. Star-San can be kept and reused for longer periods of time because the acid does not gas off or dissipate like iodine or oxidizing sanitizers. It can be reused or refreshed as long as the pH remains at or below 2.8. You can also test this with acid test strips.

**Basic Brewing Equipment**

Some basic equipment is necessary to make beer. You can add plenty of other equipment later, but these are the basics:

**Brew Pot:** Ideally you will use a stainless steel stock pot. A 3 gallon pot is the minimum size to make a 5 gallon batch of beer. You would use this pot to do a partial boil, boiling all of your ingredients in 2-2.5 gallons of water, then adding additional water (preferably boiled beforehand) to your fermenter to make 5 gallons. To do a full 5 gallon boil, you will need a 7-9 gallon pot. Using a larger brewpot and doing a full 5-gallon boil is preferable, but not necessary.
Primary Fermenter: Ideally your fermenter will be at least 1.5 gallons larger than your batch size to accommodate the vigorous foaming of the fermenting beer.

Airlock: This is a simple water trap, or one-way vent, attached to the top of the fermenter to allow the fermentation gases to escape without letting outside air into the fermenter. It is usually coupled with a rubber stopper to fit the particular hole size of the fermenter (for instance a drilled hole in a bucket lid, or the interior neck diameter of a carboy).

Siphon setup: These usually consist of a rigid tube (racking tube) and a piece of flexible hose. This is used to transfer the beer from place to place without introducing a lot of air.

Hydrometer: This is a piece of testing equipment that measures the density of the wort or beer. This density is mainly sugar content, so the hydrometer can tell us when the fermentation is proceeding and when it is finished. It can also help us tell the alcohol and potential alcohol content of the beer.

Bottle capper and bottle caps: When the beer has finished fermenting, we add a measured amount of sugar to the beer (this is known as priming) and siphon it into pry-off bottles. Once you cap them tightly using new caps, the yeast eats the priming sugar and produces CO2 which cannot escape the bottle, thus carbonating the beer.

Sanitizer: This is probably the most important thing to have. Sanitizers come in many forms and varieties. Be sure to follow the instructions on them and use them on every surface that your beer contacts. The importance of sanitation cannot be overstated. Without proper sanitation, a beer that would otherwise be terrific could taste and smell terrible, and end up going right down the drain.

Additional Optional Equipment

In addition to the above equipment, you can make the process easier with these items:

Wort Chiller: This is a coil of copper which you immerse in the brewpot with 15 minutes left in the boil. This heats the metal and sanitizes the copper. Once your hour boil is over, you can connect the chiller to a water faucet (we use garden-hose fittings on the chillers we sell, and also sell a kitchen faucet adapter if you need it) and run normal tap water through the chiller. The chiller essentially acts as a radiator, with the water flowing through the copper coil absorbing the heat from the wort and chilling the wort. Usually this will cool a 5-gallon batch in 30 minutes or less.

Secondary Fermenter (5-gallon glass or PET plastic carboy): This is a secondary vessel into which you can siphon your beer to allow it to finish fermenting and clarify. Using a secondary also gets the beer off of the yeast sediment in the primary fermenter, decreasing the chance that off-flavors could develop from contact with the decaying yeast.

Auto-Siphon: This is a very handy tool which allows you to start and stop a siphon at will, if necessary, and then easily restart it without having to resanitize the siphon.

Bottle Filler: This is another handy tool with a simple pressure-activated shut-off valve, allowing you to move from bottle to bottle in the bottling process without spillage.