INTERMEDIATE
BEER INGREDIENTS

Content contributed by Andrew VanTil, Imperial Beverage

Material contained in this document applies to multiple course levels. Reference your syllabus to determine specific areas of study.

MALT

1. What is it?
Malting is the process where a grain seed is steeped in warm water, causing it to sprout, and then dried under controlled conditions. This process initiates the growth cycle for a seed. Enzymes begin to break starches down into sugars and proteins down into amino acids that the plant would have needed to grow; the maltster then stops the process by drying the grain. This locks up those resources and preserves them for use by the brewer.

2. Why barley (and not wheat, spelt, sorghum, corn, etc.)?
While most cereal grains can be malted, brewers prefer barley for its husk, high starch content, high enzyme content, lower protein content, and relatively neutral flavor. Other grains, like wheat and rye, contribute unique flavors to beers as well, but even these beers are typically made with at least 30% barley malt.

3. Types of malt
Depending on the time and temperature of the drying process (kilning), malt products vary from very pale in color and light in flavor to black in color and intense in flavor.
Base malts—these are the lightest malts. Brewers typically use between 70-100% of these malts for all of their recipes.
Specialty malts—these are further processed through toasting, roasting, or caramelization. Brewers use these types of malts in smaller percentages because of their high flavor impact.

4. What does malt contribute?
Alcohol—malt starch is converted to sugars during the brewing process that are eventually fermented to alcohol (and CO2). If more malt is used, then more alcohol will be in the finished beer.
Color—from pale straw to black, malt is the primary determinant for color in beer. Colors range from pale straw to black. Most American craft brewers use the Standard Reference Method (SRM) to describe beer color.
Body/sweetness—malt protein and unfermented starches and sugars are left behind in finished beer. These contribute a sense of weight in the mouth and a perception of sweetness/residual sugar on the palate.
Flavor—depending on the type and amounts of malts used, a wide variety of flavors results in finished beer. A few examples of beer flavors that come from malt use include grainy, roasted, cereal, burnt, coffee, molasses, toffee, raisiny, honeyed, nutty, chocolaty, pruny, dried fruit.

(MALT CON'T)

5. How is it used?

In the brewing process, malt is coarsely milled, separating the husk from the kernel without grinding the seed into flour. The grist is then mixed with warm water and held for a period of time. This is called the mash. During the mash, enzymes naturally in the malt will break down the starches into simple sugars suitable for fermentation. At the end of the mash, the sweet liquid, or wort, is drained off the spent grain and brought to a boil in the brew kettle. After the boil, the wort is cooled down so that yeast can be added to begin fermentation.

HOPS

1. What are they?

Hops are the greenish flowers of the humulus lupulus plant, which is a vigorous climbing vine in the nettle family, closely related to marijuana. Since the late 16th century, they've been almost universally used in beer production.

2. Why hops?

The bitterness provides a counterpoint to the rich sweet character of malt. Hops are also a natural preservative; historically, the use of hops allowed table beer to be drinkable for a few months rather than a few weeks.

3. Types of hops (varieties)

There are over 100 varieties of hops used by brewers. Much like wine grapes, each variety exhibits a particular flavor and aroma profile, but this profile is expressed differently depending on where it is grown. Some varieties are prized for their bittering potential and others for their aromatic oil content. Many hop varieties historically were grown in particular regions. Because of this, these varieties have come to be associated with particular beer styles.

Major regions and some associated varieties
UK—Kent Goldings, Fuggles
Germany—Hallertauer (Mittelfrüh), Spalter, Tettnanger, Hersbrucker
Czech Republic—Saaz
Poland—Lublin
Australia—Pride of Ringwood
New Zealand—Pacific Gem
US (esp. Yakima Valley)—Cascade, Centennial, Chinook, Columbus, Amarillo, Simcoe, Crystal, Mt. Hood, Liberty, Sterling, Santiam, Ahtanum, Summit, Citra, Warrior, Willamette

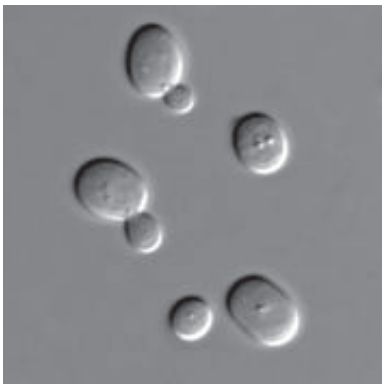
4. What do hops contribute?

Bitterness—the resins in hops become soluble after boiling, and the finished beer tastes bitter to balance the sweet malty tones.

(HOPS - What do hops contribute? CON'T)
Flavor/Aroma—the essential oils in hops contribute a spectrum of aromatic qualities. Some descriptors for hop flavors/aromas include floral—rose, geranium, lily, lavender; spicy—herbal, peppery, minty, eucalyptus, bay, sprucy, piney; earthy—grassy, hay, woody, cellar; fruity—citrus, tropical; pungent, catty.

5. How are they used?
Before brewers use them, hops are dried and sometimes ground and compressed into pellets. During the boil, brewers will add whole hop flowers or pellets at different times, depending on the desired effect. Hops added at the beginning of the boil will contribute bitterness, but the hop oils will largely boil off. To pack more hop flavor and aroma into a beer with little accompanying bitterness, brewers can add hops toward the end of the boil or even after fermentation (dry hopping). Un-dried hops used within a couple days of the annual harvest are known as wet hops or fresh hops.

YEAST


1. What is it?
Yeast is a single-celled organism in the fungus family. Saccharomyces Cerevisiae is the type of yeast known as brewer's yeast. It consumes sugar (from malt) and creates as waste products alcohol, carbon dioxide, and lots of other flavors that we know as beer (which we don't call a waste product).

2. Types of yeast
Lager (bottom fermenting)—these ferment beer more slowly at cooler temperatures than ale yeasts (40-60°F). Lagers need longer maturation time than ales because they take longer to reduce "green" flavors produced as a normal part of fermentation and because they produce sulfur flavors that the yeast needs time to reabsorb post fermentation. Lager yeasts tend to ferment beer drier than ales, and they don't produce as much fruity/spicy flavor as ale yeasts.
Ale (top fermenting)—these work vigorously at room temperature (60-80°F). They require less time to finish their fermentation cycle; beers made with ale yeasts may be ready to drink as soon as a week after brewing. Ales tend to finish a bit sweeter with more body and fruity flavors than lagers.

3. Yeast Strains
Brewers and beer aficionados spend a lot of time talking about yeast strains. We've talked about the two major types of brewer's yeast, but there are thousands of different strains within those two categories. While the basic metabolic action (yeast consuming sugar and yielding alcohol and CO2 as waste products) is the same across all strains, individual strains also create flavor/aroma compounds as additional byproducts of fermentation (they also perform differently from each other in different brewery settings, which gives the brewer some flexibility in yeast selection to help his/her individual situation). While this is true for lager yeast strains, it is even truer for ale yeast strains.

Here are a few important categories of ale yeast strains:
American Ale yeasts—these tend to be fairly neutral in character, giving the brewer flexibility for use in several styles.
British Ale yeasts—fruitier than American ale yeasts, these tend to leave more residual sugar and body in the finished beer. They also settle out of the beer readily, making them a great choice for unfiltered and cask conditioned ales.
German wheat (weizen) yeasts—these yeasts leave a strong signature of phenolic spice (cloves) and fruity esters (banana, bubble gum) in the beer, and they tend to stay suspended in beer for a long time, which contributes to the cloudy character in unfiltered weissbiers.
Belgian Ale yeasts—This is a fairly broad category of yeasts, producing beers with a huge range of fruity, spicy, and earthy characters. They don't specifically exhibit clove/banana tones like weizen yeasts.

4. How Brewers Use Yeast
At the end of the brewing process, the brewer will mix or "pitch" a prescribed amount of yeast into the unfermented beer (wort) at a controlled temperature that ensures that the action of the yeast will be vigorous and begin quickly. Within a few hours, fermentation will be apparent as the brew becomes cloudy and foam builds on the surface. Depending on the type of yeast used, this will continue for one or more weeks until the yeast has multiplied and consumed the simpler sugars in the wort, producing what will become beer after additional maturation. For some very traditional styles, brewers will also rely on yeast and bacteria in the air or in the fermentation vessels (often wooden barrels) to naturally begin fermentation. Typically, such beers will be at least a bit sour but also quite complex.

WATER

1. What role does it play in beer?
Water makes up more than 90% of most types of beer, and it's also used as part of the production process in brewing, so the quality of the water used for brewing is really important. Apart from the actual H20 itself, trace minerals and elements in water are important for yeast health and can improve a beer's flavor.

2. Historical implications
Brewers throughout history have generally understood the importance of water quality, so it's no accident that many of the world's classic beer styles were developed in places with a particular type of water that turns out to have been well suited to that style. For example, London is famous for its dark ales. Even if the brewers at the time didn't understand it, it turns out that the carbonates in London's water were what rounded the bitter edges of the roasted malts used to make those beers.

3. Modern realities
Even though many breweries may still use the same artesian water source that they have for over a hundred years, most of the brewing world today has access to treated water from a municipal source. If desired, brewers can change that water to suit their needs through a combination of filtration, chlorine removal, and addition of minerals.