

Hops

What Are Hops?

The hop is a flowering, vine - *Humulus Lupulus*. Brewers use the flowers or cones of the plant.

What are the important properties of hops for brewing purposes?

Bitterness

One of the most important effects of hops in the brewing process is to add bitterness to your beer. This bitterness balances the sweetness that comes from the other major ingredient in beer - barley malt. Without the bittering effect of hops, beer would be a very sweet drink.

Hop bitterness comes from a group of compounds called **alpha acids**. The major alpha acids are **humulone**, **cohumulone**, and **adhumulone**. All of these compounds are bitter and will, when properly used, provide bitterness in your beer.

In order to achieve the hop bitterness, these alpha acids must be added to your wort and boiled for a substantial period of time. The acids will enter the wort fairly quickly, but if they are not chemically altered by a process called "isomerization", they will not remain in the wort when it is cooled. This isomerization process takes approximately 45 - 60 minutes to occur. (See the graph supplied.) The implication of this for a brewer, then, is that to achieve hop bitterness, the hops must be added to the boil and boiled for 45-60 minutes.

To measure the bittering effect of hops, we have two major measuring scales. One is the simple scale called either the **Homebrewing Units (HBUs)** or **Alpha Acid Units (AAUs)**. This scale measures the amount of alpha acids that you add to your wort. The measurement technique is quite simple. Simply multiply the number of ounces of the hop added by that hop's alpha acid percentage rating to get the number of HBUs or AAUs. The higher this number, all other things being equal, the more bitter your beer will be. So for instance, two ounces of a 6% alpha hop will provide 12 HBUs or AAUs. Similarly, one ounce of a 12% alpha hop will also provide 12 HBUs or AAUs.

The other bitterness measuring scale is the **International Bittering Units (IBU)** scale. IBUs is an actual measure of how much bitterness is in the beer, not just the amount of the bittering agents added. The HBU and AAU scale assumes complete utilization of these acids. The actual utilization depends on the length of the boil, the amount of wort being boiled and the specific gravity of the wort. A true calculation of IBUs is quite complicated. Zymurgy provides an approximate equation for calculating IBUs as follows:

The major difference in this formula from the HBU and AAU calculation is the use of the % utilization term. As an approximation, Zymurgy recommends using 25% for a one hour boil, 15% for a 30 minute boil and 5% for a 15 minute boil. Thus, for a five gallon batch of beer, if you boil one ounce of a 10% alpha hop for one hour and one ounce of a 5% alpha hop for 30 minutes, you would have approximately 48.5 IBUs

Whatever scale of measurement you use, the level of bitterness in your beer will depend in large part on how many ounces of hops you use and the alpha acid percentage of those hops. Thus, to achieve a high level of bitterness requires either a large amount of low alpha hops or a smaller amount of high alpha hops. There is some debate as to the best approach. On the one hand, a smaller quantity of hops is generally cheaper and easier to handle. This favors the approach of using a small amount of high alpha hops.

On the other hand, it is generally true that the higher alpha hops possess a higher percentage of cohumulone than the lower alpha hops do. Cohumulone tends to have a somewhat harsh character to it than the other alpha acids. This tends to favor the approach of using a larger quantity of lower alpha hops.

On the third hand (!), it has been suggested that using larger quantities of hops will tend to add grassy flavors, favoring the approach of using smaller quantities of high alpha hops. Thus, even though

hops and their use as a bittering agent in beer has been studied extensively, there are still some unanswered questions.

Flavor and Aroma

Hops also contain Essential Oils that will provide flavor and aroma characteristics to your beer. The most important of these oils are **myrcene**, **humulene**, **caryophyllene**, and **farnesene**. Unfortunately, they are very volatile, meaning that prolonged boiling will cause them to evaporate from the wort. Thus, if you want to achieve the flavoring and aroma characteristics of hops, boil them for a short time. The standard suggestions are that a 15 minute boil will provide the flavor components and a 5 minute (or less) will provide the aroma characteristics.

Another method for achieving hop aroma in your beer is called “dry-hopping”. This refers to putting hops into the fermenter. Since the beer will not be boiled, the essential oils will not be dissipated.

Forms of hops for homebrewers

Hops come to the brewer in three major physical forms:

Whole Hops - Essentially, this is just the dried hop cones as they come off the plant

Hop Pellets - Hop pellets are produced by grinding the hops into a powder. This powder is then formed into small pellets. The oils and resins in the hop act as the binder to hold the pellets in the desired shape.

Hop Plugs - Hop plugs are just compressed whole hop cones.

In choosing which form is best, there are several factors to take into account. An important issue concerns the freshness of the hops. The active ingredients in hops are fairly volatile and can be lost from easily. The major factors in hop maintaining hop freshness are to keep them cold and to keep air away from them. Whole hops are particularly susceptible to losing their freshness since they have so much surface area exposed to air. This is one of the major advantages of pellets - by being so compact, the amount of surface exposed to air is much smaller than with whole hops. On the other hand, the grinding of the whole hops to create the pellets results in the loss of some oils. Thus, whole hops may possess more of their original character than hop pellets do. Hop plugs are considered to be a compromise between the whole hops and hop pellets. Since they are not ground, the oils are not lost, but since they are compressed, their exposed surface area is reduced.

From a practical brewing standpoint, there are other issues. More varieties are available in pellet form. This is probably due to the economies in shipping and storage that result from the reduced size. By the same token, whole hops and plugs are also generally slightly more expensive than pellets.

Techniques for removing hops from wort will also vary depending on which form you use. Whole hops or hop plugs may be removed with a screen filter system. Hop pellets, on the other hand, reduce to a very fine powder sludge which will clog most screens. Therefore other methods must be used to separate hop pellets residue from wort

Varieties of Hops

There are many different varieties of hops, each with its own profile of alpha acids and essential oils. These profiles result in different bittering power if used as bittering hops and different flavors and aromas if used in that manner. An abbreviated list is provided.

Sources:

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