Maturation of Cask Conditioned Beer

English brewers have traditionally aged their ales for only 3-5 days in the brewery prior to shipping to the bar. The bar may only keep it 7 days and in some cases may serve it immediately. It is conceivable that the beer in the customer's glass is only 7 days old. American brewers will find this hard to adjust too as there is still a tendency to "lager"ales in this country. Inside the cask the ale is "coming into condition" which means that along with a small amount of flavor generation the beer naturally carbonates itself.

Yeast Count

The beer must be prepared for cask conditioning to ensure consistency. It is important to ensure that an even consistent yeast count be achieved before racking. It is difficult enough to control the fermentation occurring in the cask as it is, so care should be taken to ensure consistency in the parameters that can be controlled. If the yeast behaves consistently and always leaves in suspension the right amount no matter how much you pitch, how much growth occurs, when you skim, how much you skim, when you chill, and how long the beer sits before racking then a consistent yeast count can be achieved. However this situation is unlikely, so monitoring of the yeast count is recommended. Some brewers will filter beer then add back a measured count of yeast, others will fine the beer and do the same. Most will aim for consistency in their fermentation practises and if a batch shows a problem with yeast count, either wait until it is right, or blend it off. The correct yeast count at racking should be between 0.5 and 3 x 10^6 cells/ml based on the yeast strain and the yeast should be viable and healthy. Counts in excess of 4 x 10^6 cells/ml can cause problems for isinglass clarification. Removal of yeast from a primary fermenter by skimming or dropping will usually leave behind the required amount. Brewers fermenting in closed cylindroconical fermenters have a problem in that the beer takes much longer to reach the desired yeast count at the racking port. One option is to use finished beer of the same type to dilute the yeast count to an appropriate level.

Priming

There should be between 0.1^o and 1.0^o Plato present in the beer for secondary fermentation. Some brewers rack beer into a cask when the beer in the primary fermenter reaches 1-2^{o}P above terminal gravity. This wastes a lot of beer, due to overfoaming during filling, poor yeast settling and excessive solids in the bottom of the cask. If the brewer waits for the correct yeast count then it will be necessary to add fermentable extract in the form of primings. This is normally added into the bulk beer just prior to racking. The beer should be transferred to a racking back prior to racking to ensure an even distribution of yeast and fermentable material throughout the beer. It is a simple matter to add primings directly to the cask prior to racking if only a few casks are to be filled. Brewers have a variety of options when it comes to sources of extract for secondary fermentation, and the brewer should experiment to discover which method works the best.

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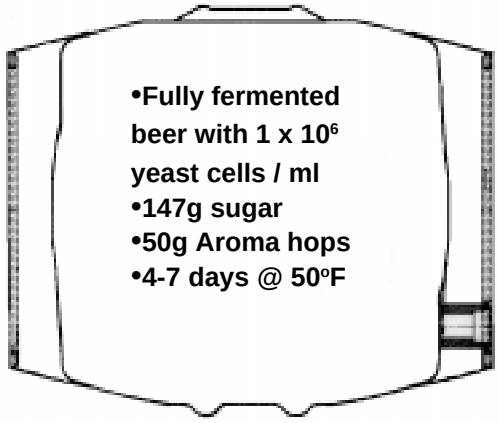
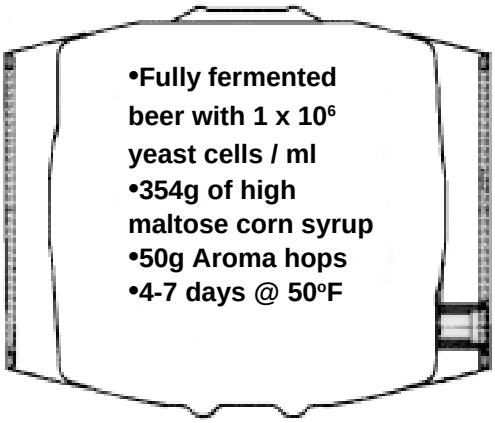
Cask conditioning Handout

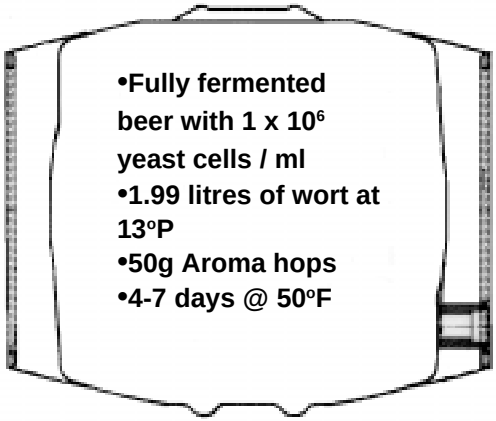


Sucrose
When it ferments fully it ferments very quickly and leaves no residual sweetness. Healthy yeast can utilize sucrose by first splitting it to glucose and fructose. If it does not ferment fully it will leave a sweet sugary taste in the beer.

Dextrose
Ferments at a moderate pace but can leave a "honey" sweetness if not fully fermented out. It is the most commonly used priming sugar in the USA due to it's availability.



Maltose Syrup.
Many English brewers have success using this material which is less sweet and increases mouthfeel, but it is very difficult to find in this country. Do not confuse this with maltodextrin which is a largely unfermentable "body sugar." High maltose corn syrup can be used as a substitute that is more readily available in this country. Corn syrups can contain up to 52% fermentable extract consisting of up to 40% maltose, and 12% dextrose, and more closely mimic the fermentable makeup of wort. This results in a slower, more gradual, controllable secondary fermentation, but without additional FAN, proteins or potential haze forming material.



Wort and Krausening
A lot more material needs to be added to provide the same fermentable extract as sugars. When you add wort you add more dextrins, more FAN and more proteins to already fermented beer. The krausening step in lager maturation is followed by a long period of ageing and chill stabilization, whereas with ales the aging process is shorter and the added haze forming material can be a problem. Fal Allen, Dick Cantwell, and Kevin Forham at Pikes Brewing in Seattle report that they had good results using actively fermenting wort as a priming agent, but very few English brewers use this method. It is difficult to add both the correct volume of fermentable material and yeast using this method. Malt extract presents similar problems.

Cask conditioning Handout

	Firkin	U.S. 1/2 bbl
Imperial Gallons	9	12.865
U.S. Gallons	10.8	15.5
Liters	40.9	58.5
Total CO_2 @ 0.9 vol.in liters	36.82	52.64
Volume CO_2 / 0.1 vol increase in liters	4.09	52.64
Weight CO_2 @ 0.9 vol.in grams	73.65	105.27
Weight CO_2 / 0.1 vol increase in grams	8.18	11.70
2.0grams of Glucose gives 1.0 gram CO_2		
Weight of sugar / 0.1 vol.increase in grams	16.37	23.39
Weight of wort @ 13% Plato and 60% fermentability / 0.1vol.increase in grams.	209.82	299.93
Volume of wort @ 13% Plato and 60% fermentability / 0.1 vol.increase in milliliters	220.73	315.52
Weight of corn syrup at 80% solids and 52% fermentability / 0.1 vol.increase in grams	39.34	56.24

	Volumes C					
Amount Per Firkin	1.0	1.1	1.2	1.3	1.4	
Weight of sugar ie dextrose / sucrose / fructose in grams	16	33	49	65	82	
Weight of wort @ 13% Plato and 60% fermentability in grams.	210	420	629	839	1049	
Volume of wort @ 13% Plato and 60% fermentability in milliliters	221	441	662	883	1104	
Weight of corn syrup at 80% solids and 52% fermentability in grams	39	79	118	157	197	

Cask conditioning Handout

Clarification.

It is important that cask conditioned beer be crystal bright when served. Traditional English brewers use isinglass added to the beer, just prior to dispatch and after conditioning in the brewery, in combination with an auxiliary fining added at racking, and kettle finings in the brewhouse.
Malt choice should also be considered when discussing clarity. Since there is no filtration of the beer yet the product is expected to be crystal bright it is better to use malt with a low total protein level. In fact most brewers of cask conditioned beer recommend protein levels of between 7 and 10%.

Kettle fining

When relying on sedimentation in the cask for clarity it is important to ensure that most of the potential haze forming material is removed earlier in the process if possible, so the correct amount of kettle fining will influence final beer clarity, ease of fining and the volume of material left behind in the bottom of the cask.

Isinglass

Isinglass is extracted from the swim bladders of selected tropical fish. It is triple helical protein which, when prepared in acid solutions, is a clear viscous substance with a net positive electrical charge. When added to beer it will attract the negatively charged yeast cells and some similarly charged proteins and cause them to sediment more rapidly. Research also indicates that isinglass will aid foam stability by removal of some head-negative phospholipids from beer. Although you rarely see it mentioned in the brewing literature it has long been understood by brewers and cellarmen in the U.K. that you always fine on a rising temperature. Thus, it is wise to cool the beer prior to fining by 2-3 degrees, then allow the beer to warm slightly while the isinglass works. Another drawback to finings is that they will only cause the yeast to sediment 4 to 5 times, so once finings are added the beer should be moved as few times as possible. Finings are denatured at temperatures over 68^{o}F. and so preparations should be carefully stored and fined beer must be kept cool. Some commercial finings contain a sulphite preservative which can result in additional sulfites in the beer. It is necessary to determine the suitable rate of fining addition on a batch by batch basis as beers will vary in suspended yeast content. Perform a test as described to determine the correct rate for optimum sedimentation.

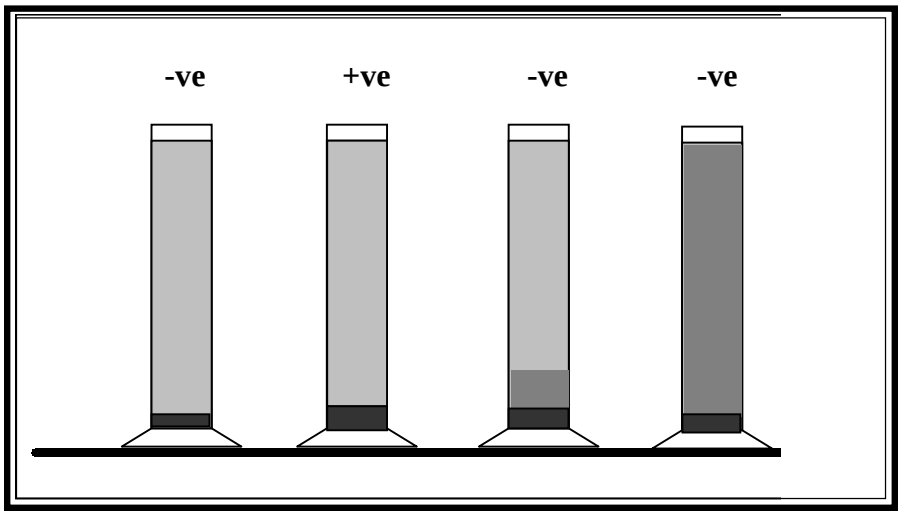
Auxiliary finings

These are used in conjunction with isinglass to aid in the removal of haze causing proteins. They may be polysaccharide or silicate in nature, and are negatively charged, and so aid in the precipitation of positively charged proteins. They should never be added at the same time as isinglass as they will neutralize each other. Auxiliary finings should be added at racking and isinglass should be added after maturation is complete. They are usually used at half the rate of isinglass, but the rate of addition should also be tested for each batch.

Determining rate of usage for finings.

Prepare the finings exactly according to the suppliers instructions. Use 4 tall glass cylinders and put 500 ml of the same beer that was racked into the cask in each. Add 2ml to one and mix thoroughly, add 4 ml to another and mix, try 6 ml and then 8 ml. Place them all out at room temperature and observe how much settles out at 12 hours and at 24 hours. Shake them up to resuspend the solids and assess how long they take to resettle. Choose the rate that worked the best giving the most stable deposit in the quickest time, then when it is time to fine the beer calculate how much to add to the cask by multiplying the ml of isinglass in the test by 82 for an English firkin, and by 117 for an American 15.5 gallon keg. Too much finings will cause the sediment to be loose throughout the whole cylinder, not enough will only sediment out a small portion of the yeast and haze.

Cask conditioning Handout



The beer should be sold as soon as possible after it has been fined, which is why self distribution is preferred. A beer can use up a lot of it's life sitting on a distributors warehouse floor. Storage temperature is even more important with cask beer than with keg beer, as the flavor and the fining action can quickly deteriorate at elevated temperatures.

Dry Hopping

The addition of hops to a cask will dramatically effect the flavor of a beer, so great care must be taken to avoid the tendency to over hop. Whole leaf hops are the best option because they are easier to restrain in the cask. They are unaffected by finings and will collect either on the surface around the shive or on the bottom of the cask. The degree to which hops affect beer flavor is influenced by the variety of hop, the amount added and the contact time. Maturation of up to 7 days in the brewery, time in the cellar and serving time can all influence the level of perceived hop aroma. Due to the tendency of volatile essential oils to oxidize, the change in flavor seen during serving over a number of days is greater in dry hopped beers. Many English brewers have discontinued this activity due to the inconsistency problem and also the problems it leads to with cask washing and effluent. Hopping rates can really only be determined by trial and error but amounts vary from $\frac{1}{8}$ - 1 oz. per cask

English varieties suitable for dry hopping

Wye Challenger: A popular English hop used for all aspects of brewing.
Fuggle: Classic English aroma variety, although it is rather mild, rounded and subdued in character.
First Gold: A dwarf variety of WGV and similar in aroma
East Kent Goldings: The classic English aroma hop. Can be assertive when used in large amounts.Often blended with fuggle for a more rounded character.
Wye Northdown: A derivative of Northern Brewer, but with more pronounced aroma qualities.
Wye Target: A very high alpha content and a floral aroma make this a very good all purpose hop. This is frequently used to produce CO_2 extracts for aroma.
WGV (Whitbread Golding Variety): Actually classed as a substitute for Fuggles.

U.S. Varieties used for dry hopping

Willamette: Bred from Fuggles and grown only in the U.S.A.
U.S. Fuggle: It is said to have a more “pungent” aroma than the English counterpart
Liberty: Grown as a triploid cross from German Hallertau, it apparently has an aroma reminiscent of a mixture of Fuggle and Goldings
B.C. Kent Goldings: Goldings grown in British Columbia have similar characteristics to those grown in England
Centennial: A high alpha hop with an intense floral and citrus aroma.

Storage Conditions

Store casks with the shive hole vertical to ensure that the sediment doesn’t form around the keystone and that the headspace is next to shive. This will allow successful venting of the excess pressure without loss of beer. Storage should be at 50-55^{o}F if possible provided that the yeast is capable of fermenting at these temperatures. Higher storage temperatures will speed up the maturation rate but the beer will hold less carbonation unless it is chilled prior to venting for fining or serving. Lower temperatures will cause ale yeast to be inactive or to sediment out preventing further maturation.