

Understanding and Controlling Fermentations

Controlling Fermentations

1. Fermentation temperature

There are four main factors that effect the rate and quality of fermentation and so the final beer. It is often necessary to adjust one or more of these parameters to obtain the perfect fermentation rate for the specific type of yeast being used. The four areas, which need to be controlled, are fermentation temperature, volume of yeast used at the start of fermentation, volume of oxygen in the wort at the start of fermentation and finally the fermentability of the wort.

Each yeast type has a range of temperatures, which produce the best fermentation rate, and balance of flavours. The brewer must adjust these temperatures to suit their environment. It is often necessary to adjust the temperatures several times during the year, as the local conditions change. The two areas under the brewer's control are the temperature at which the fermentation starts and the maximum temperature the fermentation is allowed to reach.

a) Start Temperature

If the temperature at which the yeast is added to the wort is too low the initial fermentation rate will be slow, if the temperature is too high the yeast can be 'shocked' and will produce a beer with a poor flavour.

b) Maximum Temperature

The maximum temperature the beer is allowed to ferment at has a very important effect on the flavour and rate of fermentation. Too fast or too slow a fermentation is bad and should be avoided. It is important to remember with fermentation one degree change can make a big difference and any changes should be made slowly over a period of time.

2. Volume of yeast

The more yeast pitched into the wort at the start of fermentation the faster the fermentation rate. More important is the fact that if not enough yeast is used the fermentation rate will be slow and may not reach the desired final gravity.

3. Volume of oxygen

During the initial stage of fermentation the yeast uses the oxygen to multiply, when the oxygen is gone the yeast starts to produce alcohol. Adding oxygen throughout the wort cooling into fermenter will produce maximum yeast growth and a faster fermentation. Reducing the oxygen level will slow down fermentation but over several generations can have a bad effect on the yeast, greatly reducing viability.

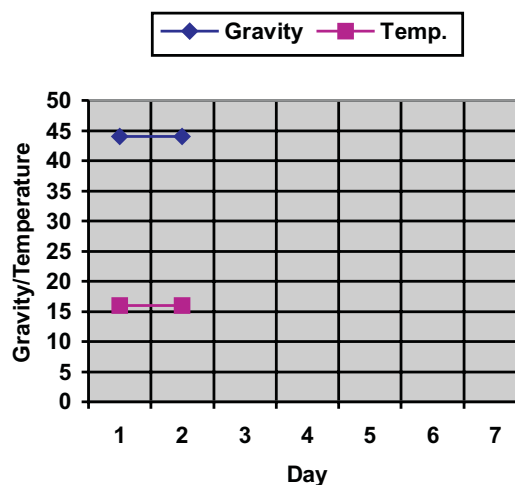
4. Wort fermentability

Wort fermentability is the ratio of fermentable sugars to non-fermentable sugars and can be altered by changing the mashing temperatures and times. The results are often noticed more by the effect it has on the final gravity that can be reached rather than the fermentation rate.

Fermentation Problems and Solutions

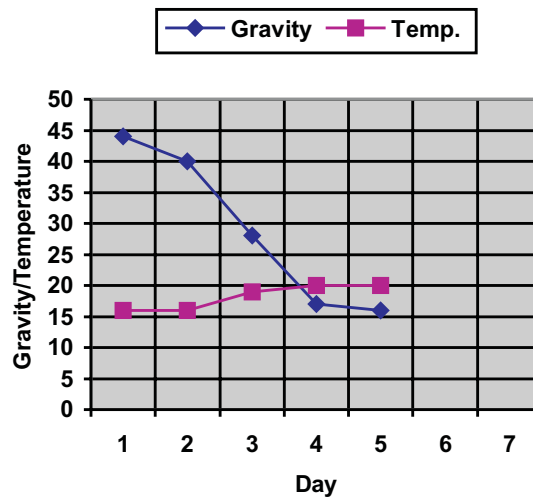
1. Slow start

If after 48 hours there is no sign of a drop in gravity and no increase in the temperature of the wort then fermentation has not started. It is advisable to add oxygen to the wort via the bottom inlet/outlet valve or the sample cock. The oxygen will promote further yeast growth and help to get the yeast into suspension. Gently add the oxygen into the wort for 30 minutes. If fermentation is very slow at the start there is always the opportunity for bacteria to infect the wort. See figure 1.



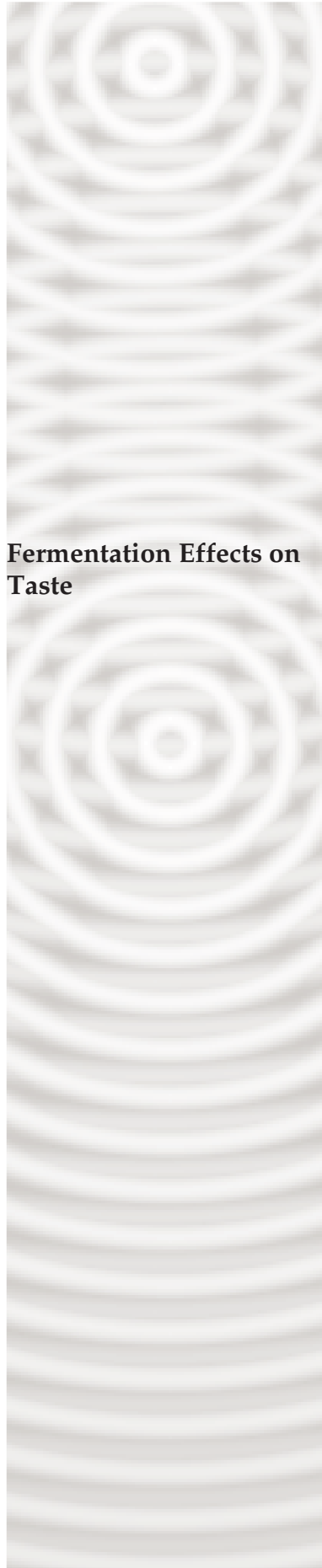
2. Sticking fermentations

Occasionally a fermentation may slow down and stop at a gravity between 20 – 12 degrees. This can be caused by low initial pitching rate, loss of fermentation temperature or flocculation of the yeast. The beer should be mixed by pumping out of the bottom yeast outlet valve and returning the beer through the beer outlet valve, this mixing should be for 30 minutes using a low pump speed. Care should be taken during mixing or the beer may fob and flow out through the CIP feed line. See figure 2.

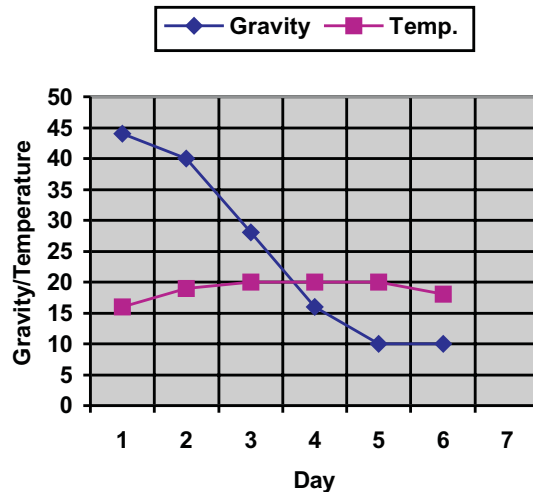


3. High final gravity

Occasionally the beer may stop fermenting a few degrees above the required final gravity. This is normally a sign of low pitch rate, yeast nearing the end of its useful life or too little oxygen added to the wort over several generations of the yeast's life. If the gravity is only one or two degrees above that required it is best to leave the beer and just cool it. If the gravity is over two degrees above that required it is advisable to rouse the beer to promote further fermentation. See figure 3.



Fermentation Effects on Taste



If the beer does not ferment enough and the final gravity is high the beer will have a sweet taste and the alcohol level will be low.

If the beer ferments too much and the final gravity is low the beer will taste thin and the alcohol level will be high.

High fermentation temperatures produce beer which is high in esters, it will taste fruity like apples or bananas etc. This may be acceptable in a high gravity beer but is not normally wanted in low bitterness, mild flavour beers.

Infection in beer often causes an acidic or sour taste and can be caused by poor cleaning and hygiene or infected yeast.

Other flavours which may be noticed are diacetyl – buttery sweet flavour, can be caused by many factors including yeast infection and can disappear during maturation.

Sulphury – bad eggs, often caused by high levels of sulphate in the water supply or yeast strain, normally disappears during processing.

DMS – blackcurrant flavour, usually a by-product of lager yeast fermentations, may be reduced during maturation.

Yeast parameters

Yeast Type	3056	1007	1056
Description	Weizen	Alt	Ale
Fermentation Temperature °C	18 - 21	13 - 19	16 - 22
Fermentability%	73 - 77	73 - 77	73 - 77
Flocculation	Med.	Low	Low

Mixed yeasts

Some yeasts used in the brewing process use more than one yeast strain, 3056 is an example. If one strain is more flocculent than the other, over a number of generations the flavour and character of the beer will alter due to the balance of the yeast strains changing.

Reasons for cooling

Slow down or stop the fermentation and help the yeast to flocculate and settle.

Reasons for maturation

There are two main reasons for maturing beer.

1) Flavour Changes

Many flavour changes occur during this process and the beer improves over time. Strong beers normally take longer to mature than weaker beers.

2) Haze Formation

Haze forming materials are removed from the beer making it easier to filter and increasing its drinking life. Beer should always be matured at least 1°C lower than the serving temperature or it may produce a 'chill haze' in the glass, which should disappear as the beer gets warmer.