

Flocculation Basics

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Brewers have created their own unique vocabulary. Words such as pitching, attenuation, and flocculation take on special meaning to brewers. *Pitching* is adding yeast to wort to start fermentation. *Attenuation* is the percentage of sugars yeast consume during fermentation. The magical art of yeast coming together, dropping to the bottom of a fermentor, is called *flocculation*.

Flocculation is a desirable and important characteristic that is unique to brewers yeast. When brewers yeast nears the end of fermentation, single cells aggregate into clumps of thousands of cells, and drop to the bottom of the fermentor, leaving clear beer behind. If yeast flocculate too early, the beer will be underattenuated and sweet. If yeast do not flocculate, the beer will be cloudy and have a yeasty taste.

Most strains of yeast, which brewers call “wild” yeast, do not flocculate well, and remain in suspension for extended periods of time. The ability to flocculate is a product of natural selection. Brewers have continually collected yeast either from the bottom or top of a fermentor and in doing so, selected for increasingly flocculant stains. The chemistry of flocculation is complex, and will be the subject of a future article.

Yeast flocculation can be classified as high, medium, or low (see fig.1). Ale yeast strains are found in each category, while lager yeast are predominantly medium flocculators. An English/London Ale strain would be a high flocculator, while an California/American Ale strain a medium flocculator. A Hefeweizen strain is an example of a low flocculator. It is difficult to tell which category of flocculator is used to produce individual commercial beers, because most commercial beers are filtered before being bottled or kegged.

Flocculation Degree	Notes
High Flocculation	Start to flocculate by day 3-5* Sometimes need to rouse the yeast. Higher levels of diacetyl. Lower attenuation. Good for malty ales.
Medium Flocculation	Start to flocculate by day 6-15* Ideal for ales. Clean, balanced flavor production. Also called “powdery”.
Low Flocculation	Not start to flocculate by day 15* Most wild yeast are low flocculators Good for hefeweizens, belgians Makes a headache for filtering!

Figure 1

*When kept at fermentation temperature. Lowering the temperature will promote flocculation.

High flocculation is a characteristic of many English origin yeast strains. The yeast will begin to clump in 3-5 days, and drop to form a compact yeast cake at the bottom of the fermentor. When the fermentor is swirled, the yeast will stay together as a large yeast cake. Some yeast is so flocculent that it can clog openings and valves! High flocculators can require special attention to produce a well balanced beer. The yeast will often need to be “roused” back into the beer by gently swirling the carboy, or with a commercial fermentor, gently blowing CO₂ into the bottom of the fermentor. High flocculation is usually associated with lower attenuation and increased levels of diacetyl and esters. These compounds lend well to English style ales.

Medium flocculators tend to produce “cleaner” beers. They stay in suspension longer, and reduce diacetyl and esters to a greater degree. The attenuation is also greater. In a brewery, they are slightly more difficult to work with than high flocculators because of the increased work and filtering material required. A homebrewer usually does not filter, so medium flocculators just take a little more time to settle out than high flocculators. Medium flocculators will flocculate best at cold temperatures, where high flocculators can flocculate well at 65°F. Medium flocculators are well suited for American style ales, which are usually heavily hopped. The clean flavors from the yeast allow the hop aroma and flavor to come through.

Low flocculators are rarely used in brewing. Because they do not settle out of the beer, they create filtering problems and haze. But some beers are intended to have yeast in suspension. For example, German Hefeweizens and Belgian Wit beers are fermented with yeast strains that do not flocculate well, leaving the desired cloudy appearance. Most lager yeast is between medium and low in flocculation. Lagers go through an extended cool fermentation and lagering process, and the yeast needs to stay in suspension during this process. The more contact the yeast has with the beer, the better able the yeast is at reducing the diacetyl and ester level.

The primary determinant of flocculation is the particular yeast strain itself. Proteins on the cell surface determine the degree of flocculation, and proteins are coded by the DNA of yeast. Each strain has subtle differences in DNA, which will make a different set of proteins displayed on the cell surface. Other factors that can influence the degree of flocculation include the original gravity of the wort, temperature of the fermentation, pitching rate of the yeast, and initial oxygen content of the wort.

Low temperatures promote flocculation. More yeast will drop out of solution at 40°F compared to 70°F, and more yeast will drop out at 38°F compared to 40°F. Some yeast strains require 2 weeks at 40°F to completely clear.

The flocculation character of a yeast strain has a direct impact on flavor and performance. Highly flocculent yeast generally is less attenuative. The ideal yeast strain would be highly flocculent, with good attenuation, and provide the desired flavor contribution. Published flocculation characteristics can be used to help design your beers.