Doctored Beers – V2 – 9/13/2011

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Diacetyl

How to identify: Diacetyl can be recognized as an artificial butter, butterscotch or toffee-like aroma and/or taste. It may also produce a slickness on the palate, and may taste rancid at higher levels.

Details: Diacetyl is a ketone that is normally produced near the beginning of the fermentation cycle (it comes from Lactoacetic Acid which comes from Acetaldehyde), but is typically reduced enzymatically by the yeast near the end of fermentation. A beer that takes a long time to start active fermentation may produce excessive Diacetyl – more than can be reabsorbed later. Exposure to oxygen during fermentation may also cause higher levels of Diacetyl – so be sure to aerate your wort – but ONLY before or in the early stages of fermentation. Also, the yeast may not be able to reduce the Diacetyl into Butanediol (which is flavor-neutral in beer) if the FAN (Free Amino Nitrogen) is too low (for example, by using too much unmalted grain or sugar, particularly in low-gravity wort – add yeast nutrient to help with this). Highly flocculent yeasts will also leave more Diacetyl in the beer since the yeast will precipitate out of the beer before it has had a chance to reduce most of the Diacetyl. Colder fermentation temperatures (for example, lagers) cause the Diacetyl to be reduced less – so often a Diacetyl Rest (bringing the beer to 60-68°F for a few days) is used during secondary fermentation to allow the yeast to eliminate more of the Diacetyl. Krausening also helps reduce Diacetyl because it introduces fresh, active yeast after most of the secondary fermentation has been completed. Diacetyl can also be produced by *Pediococcus* and some strains of *Lactobacillus* bacteria due to contamination, but these bacteria also produce lactic acid, so the beer will also have an acidic character.

Beer styles: Diacetyl is acceptable (at low levels) in most ales, especially Scottish Ales (BJCP styles 9A, 9B, and 9C in the 2008 guidelines), but is not expected in lagers – other than Bohemian Pilsner (2B). Note that carmelization may be mistaken for Diacetyl in Strong Scotch Ales (9E).

Note: The sensitivity to Diacetyl varies from taster to taster – some tasters are unable to perceive it all.

Phenolic

How to identify: Often produce spicy notes, but also medicine cabinet and mouthwash.

Details: Many phenolics are produced by yeast (for example, cloves). Phenolics can also come from the hops, the barley, and the water. Other phenolic flavors include black pepper, smoky, band-aid, plastic. Overcrushed, oversparged, or too high of a sparge temperature can leach harsh and astringent tannin phenols from grain. Infection with wild yeasts or bacteria can produce the band-aid/plastic phenolics. Chlorophenol can come from chlorinated (or chloramine) water – use a Campden tablet to remove – and also from not rinsing enough after using bleach for sterilization.

Beer styles: Hefeweizen is expected to have clove phenolics. Chlorophenol and medicine cabinet/band-aid phenolics are never acceptable. Many Belgian beers have some phenolics.

DMS

How to identify: DMS (Di Methyl Sulfide) can be recognized as a cooked vegetable (e.g., corn or cabbage) aroma and/or taste.

Details: DMS is produced by reduction of SMM (S-Methyl Methionine) from heat. SMM is produced during malting, but is eliminated during malting in roasted or toasted malts – so it is generally found in light base malts (e.g., lager). DMS evaporates during the boil – which is why you should have at least an hour of good rolling boil, and also why you don't want to cover the wort during the boil. Slow cooling of the wort will also produce DMS while the wort is still hot, because the DMS will not be eliminated by evaporation. DMS can also be removed by the carbon dioxide during a vigorous fermentation, so warmer fermented ales will eliminate more DMS than lagers. DMS can also be produced by infection from wild yeast or *Zymomonas* bacteria, and will have more of a rancid character – like cooked cabbage.

Beer styles: DMS is acceptable (in low levels) in lighter lagers, but should not be found in ales.

Sour/Acidic

How to identify: A sour or acidic character is detected on the back sides of the tongue, and can be recognized as a vinegary aroma and/or taste.

Details: These flavors typically come from esters related to lactic or acetic acid. Lactic acid is produced by bacteria (present in dust and saliva) like *Lactobacillus* and *Pediococcus* (see also Diacetyl). Acetic acid is produced by bacteria *Acetobacter* and *Zymomonas* (see also DMS), and also by *Brettanomyces* yeast. In most cases, these flavors are due to contamination, sanitation, or lack of sterilization of the wort.

Beer styles: These flavors are not appropriate for most styles of beer. However, Sour Ales (BJCP style 17 in the 2008 guidelines, including Lambics, Flanders ales, and Berliner Weisse) have these flavors intentionally. These flavors are produced by *Brettanomyces* yeast and Lactobacillus bacteria, as well as other natural occurring yeasts and bacteria. Belgian Specialty Ales (16E) may have sour characteristics, and Belgian Wit (16A) and Saison (16C) may have a light sour/tart character.

Others

Other flavors (sometimes desirable, sometimes not) include fruity, estery, bubblegum, pineapple, papery, cardboard, sherry, green apples (acetaldehyde), soapy, cheesy, lightstruck (skunky), metallic, blood.

References

George Fix - "Principles of Brewing Science"
Brewing Techniques – July/August 1993 – "Diacetyl Formation, Reduction, and Control"
John Palmer – "How to Brew" (www.HowToBrew.com)
2008 Beer Judge Certification Program Style Guidelines (www.bjcp.org)