Tech Corner

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What can we say about troubleshooting off flavors and aroma in beer? First, if you bottle your brew then you should avoid clear bottles because light that passes through the clear bottle will interact with hops to produce a skunky aroma. For the chemist in the audience, the reaction is caused by ultraviolet light which initiates a breakdown of the hop alpha acid humulone, which reacts with hydrogen sulfide to create a molecule called mercaptan. Mercaptan is the same molecule that skunks use to generate their distinctive odor. The solution to skunky beer is to always use brown bottles and avoid long exposure to light. Also, if you use a glass fermenter, make sure you ferment in a dark area or at least cover the fermenter to protect it from light.

Another off flavor is caused by acetylaldehyde. During a normal fermentation acetylaldehyde is converted to ethanol; however, if fermentation is incomplete the acetylaldehyde that remains may impart an aroma and flavor of freshly cut green apples to your beer. Also note, if your finished beer is oxidized, then the reaction may be reversed. That is, ethanol can be converted back into acetylaldehyde and acetic acid. This combination may give your beer an acetic/cider aroma and taste that is reminiscent of rotten apples. A bacterial infection can be another source of acetylaldehyde.

We can control the amount of acetylaldehyde by fermenting properly and completely. To this end, use healthy yeast and pitch the proper amount of yeast. In addition, yeast need oxygen to begin the fermentation process, however, after the initial aeration of the wort, just prior to pitching the yeast, handle the beer carefully to avoid oxygen contact. And finally, use proper sanitation to avoid a bacterial infection in your brew.

One more source of off flavors and aromas is dimethyl-sulfide (DMS). DMS may create an aroma and flavor of cooked vegetables like corn, celery, or cabbage. And in some cases, DMS may produce shellfish or oyster-like aromas and flavors. The precursor to DMS is S-methyl methionine (SMM) which is formed during malt germination. Excessive levels of SMM and subsequent DMS levels are controlled by the maltster. Assuming you have malt with appropriate levels of SMM, then the brewer can control SMM and therefore DMS amounts by performing a vigorous open rolling boil for at least one hour. The strong open boil will evaporate SMM. After the boil, cool the wort as quick as possible because cooling the wort slowly can also lead to higher levels of DMS. During a vigorous fermentation, CO_2 bubbles can carry away DMS. So, ales that typically ferment at higher temperatures with a more vigorous fermentation, may have lower levels of DMS than cooler and less vigorous fermenting lagers. Wild yeast can also produce high levels of DMS, so make sure you use proper sanitation to avoid these unwanted bacteria. As a final note, some beer styles like American light lagers and Classic American Pilsners may contain low levels of DMS and still be within the style guidelines.

If you would like to read more about troubleshooting off flavors in beer here is a good resource:

Brew Chem 101, by Lee W. Janson