

Charlotte Beer Babes: Off-Flavor Class

Hosted at Divine Barrel Brewing

Welcome to the [Charlotte Craft Beer Week](#) beer education class on Beer Off Flavors, taught by Bethany of the [Charlotte Beer Babes](#), and hosted at [Divine Barrel Brewing](#)!

We are going to go through a selection of 12 Off Flavors, and 4 good beers, during our session. We will be limiting the sample size of the Off Flavors, and there is no pressure to finish them. You will also get a sample of the base beer to sip on to compare the spiked Off Flavor samples to as you taste. These Off Flavors come in 1 ml vials, and get mixed with 1 L of beer. These are from the Siebel Institute, but there are other companies that make them as well.

So, what *is* an Off Flavor in beer anyways? Simply put, it is an unexpected and usually undesired flavor compound that can appear in beer. There are some Off Flavors that are desired or even pleasant, but they are usually undesired and also mildly to strongly unpleasant. They are also quite common. One of the reasons sensory panels are becoming more popular for breweries of all sizes to have, is to identify and help avoid Off Flavors that appear when they aren't wanted and/or above the "allowable" threshold.

What is an Off Flavor Threshold? This is the allowable amount of a given Off Flavor, typically a level that renders the Off Flavor unnoticeable (or barely noticeable). Some styles of beer allow for a low threshold of a given Off Flavor within that style. Diacetyl, a buttery-tasting compound, is a good example of a flavor that is acceptable at different levels in products: for most lagers it's regarded as an off-flavor when observed at greater than 45 ppb, but at low levels in an English-style Bitter it is considered an acceptable flavor (not an Off Flavor). And yes, every compound considered an Off Flavor has a different threshold, and sometimes it varies further by beer style for that threshold level. Further, some Off Flavors are considered to not be Off Flavors in certain styles (*I'm looking at you Geraniol with hoppy beers*). This also gets into various esters and phenols perceived as by-products of fermenting yeasts.

What is an ester? Esters come across on the nose and palate as various fruit-like essences. These chemical compounds arise from yeast metabolism during fermentation, and the choice of yeast strain and fermentation temperature make a substantial impact on the level of fruity esters in the finished beer. Generally, ale yeasts prefer warmer fermentation temperatures and produce more pronounced fruity esters, while lager yeasts work best in colder conditions and impart minimal esters. However, if fermented too warm, even lager yeast can excrete fruity esters. With ale yeast, even a minor temperature increase from 60 to 68 degrees Fahrenheit can quadruple the level of esters produced.

What is a phenol? Often compared with the smell and taste of adhesive bandages, throat spray or smoke from an electrical fire, phenols make up a group of fermentation by-products that can arise from types of bacteria or wild yeast. Phenolic notes might also be extracted from grain husks that have been over-crushed or rinsed in sparge water that's far too hot. Homebrews and other packaged beers that become infected with phenol-producing wild yeast will often experience excessive carbonation. The beer will gush when opened, or bottles might explode during storage at room temperature. BJCP guidelines explain, "Phenolic flavors are generally never desirable, with the exception being the pleasant, clove-like, vanilla-like or slightly smoky flavors and aromas in Bavarian wheat beers and some Belgian ales."

When brewing beer, when can Off Flavors develop? Harvesting (malts, hops, yeast, water), Mashing (letting the malts steep with water to get fermentable sugars in Wort), Boil (boiling the wort and adding hops and any adjuncts), Flameout/Transfer (bringing the boiled wort down under 70°F and transferring to the fermentation vessel), Fermentation (adding yeast and allowing time to turn into beer), Secondary Fermentation (adding adjuncts/hops post primary fermentation stage), Bottling/Kegging (transferring completed beer into bottles or kegs to carbonate and eventually serve), and Serving (most commonly introduced from tap lines).

Resources:

<https://beerandbrewing.com/dictionary/LC061jwxZA/>

<http://howtobrew.com/book/section-4/is-my-beer-ruined/common-off-flavors>

<https://learn.kegerator.com/off-flavors-in-beer/>

<https://redrockbrewing.com/craftybeermaids/2016/01/23/certified-cicerone-study-resources/>

<https://www.nationalhomebrewclub.ie/wordpress/off-flavours-in-beer/>

<https://bisonbrew.com/off-flavors/>

<https://beerandbrewing.com/dictionary/>

<https://beerconnoisseur.com/articles/identifying-flavors-beer>

<https://www.siebelinstitute.com/>

<https://www.flavoractiv.com/>

How should I properly taste the spiked beer? Everyone will get approximately 1 oz of each Off Flavored Sample. We will then walk through a visual inspection, a “drive by” the nose, short sharp sniffs, a sip and swallow, and then an exhale through nose to finish off. Please see your “tasting page” to take notes.

Classifying Off Flavors:

- 1) Morton Meilgaard, the famous brewing sensory scientist, attempted to classify beer flavors into five categories: desirable, desirable in small amounts, desirable in specialty beers, indifferent unless in excess, and undesirable. Those flavors in the fifth category contain defects that are undesirable at any concentration and beer containing these compounds above the taste threshold would certainly be considered off-flavored. They include moldy, metallic, worty, grainy, straw-like, woody, bready, papery, chlorophenol, rancid, oily, skunky, catty, and stale. In reviewing this list, one can identify many of the above-mentioned compounds as those that are associated with oxidation or staling.
- 2) The flavor scientist S. J. E. Bennett divided possible sources of off-flavors into six groups: (i) raw materials, (ii) a shortfall in process control, (iii) microbiological spoilage, (iv) packaging, (v) storage, and (vi) accidental contamination. The task of categorizing off-flavors themselves is not as simple as it might seem. An undesirable note may have several potential causes. Diacetyl, for example, may be the result of the individual yeast strain utilized by a brewery, insufficient beer maturation time, or, worse, microbial contamination. The good brewer, therefore, is constantly vigilant and should have a well-formed idea of exactly how the brewery’s beer should taste and smell.

The Off Flavors we’ll be trying today will be:

1. Round 1:
 - a. D.M.S. - cooked corn, cooked vegetables
 - b. Diacetyl - butter, butterscotch
 - c. Earthy - geosmin, soil-like
2. Round 2:
 - a. Light Struck - skunky, toffee or coffee like
 - b. Indole - farm, barnyard
 - c. Ethyl hexanoate - aniseed, apple or licorice
3. Round 3:
 - a. Papery - cardboard, oxidized
 - b. Geraniol - floral, geranium flowers
 - c. Acetaldehyde - green apple, cut grass
4. Round 4:
 - a. Metallic - metal, tin-like, blood
 - b. Isoamyl acetate - banana, peardrop
 - c. Vanilla - custard powder, vanilla essence

Note: I have tried to get at least 1 atrocious and 1 mildly-pleasant Off Flavor in each round. One of the most critical things to understand about Tasting in general is that everyone’s palates are different. One person may not even notice a Flavor that another person may be unable to try to ignore. This goes for every type of flavor/tasting, not just Off Flavors.

Round 1 Off Flavors:

D.M.S. - cooked corn, cooked vegetables

Active compound	Dimethyl sulfide
Common sources	Wort boiled, wort cooling or contamination
Concentration	200 µg/L
Threshold in beer	25-50 µg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.

Disposal after use	Standard liquid waste disposal
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Ever taken a sip of a beer and tasted hints of cooked corn, cabbage or celery? Dimethyl sulfide, better known as DMS, this obnoxious off-flavor usually originates from a weak, unventilated or short boil during the brewing process. Experienced brewers know that a long, ventilated, rolling boil followed by vigorous fermentation will blow off most of the DMS precursor chemical. Rapid cooling of the hot sugar water (wort) produced in the brewing process also seems important in DMS elimination. Normally released from the thermal decomposition of a sulfur-containing amino acid in malt, the DMS precursor chemical can also come from spoilage bacteria and wild yeast infections in young beer.

Causes: DMS is a byproduct of boiling wort. It is formed from its precursor S-methyl-methionine (SMM). SMM is produced during the malting process. DMS can form if SMM is present anytime wort is hot. DMS can also result from having bacteria or wild yeast in your brew.

How to Detect: Remember to look for those canned and cooked vegetable flavors.

How to Avoid: The classic advice is to boil for 90 minutes if using pilsner malt. With modern malts and a typical homebrewing setup, a 30-minute boil should be sufficient to effectively boil off all the DMS. Most brewers are going to use a 60-minute boil and that is certainly long enough. The exception to this is if you are using a heritage malt produced with traditional malting methods. Other tips include keeping the lid off your kettle and ensuring a vigorous boil. Also, chill rapidly if possible.

How to Fix: There's not a lot you can do to fix this one. Aging may help decrease it a little.

Diacetyl - butter, butterscotch

Active compound	2,3-Butanedione
Common sources	Microbial contamination or improper maturation
Concentration	0.6 mg/L
Threshold in beer	0.1-0.2 mg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

Most craft beer drinkers have run across beers reminiscent of butterscotch. The artificial butter aroma and taste come from a fermentation by-product chemical known as diacetyl. Extremely low levels of diacetyl are acceptable in a few classic styles of ales, and even some lagers such as Pilsner Urquell offer a pleasant diacetyl hint. However, higher levels of this compound are not acceptable in any beer style. Produced during the early stages of fermentation, diacetyl can later be reduced by a process known to brewers as a "diacetyl rest." Raising the temperature of the young beer and its residual yeast to around 68 degrees Fahrenheit at the end of fermentation for a couple of days allows the yeast to absorb and metabolize diacetyl - making for a cleaner finished beer. Oddly, a small percentage of beer tasters cannot perceive diacetyl at any level.

Causes: Diacetyl is a byproduct of fermentation. Yeasts produce it and clean it up. More diacetyl will be produced during slow starting fermentations because yeast make more at the start of fermentation. This means a long start will produce a lot and it can be too much for the yeast to clean up. Other causes of DMS include mutated yeast and bacteria.

How to Detect: Some people are more sensitive to diacetyl than others. A lot of people notice diacetyl from a slickness on the roof of their mouths. If you feel this, look for buttery popcorn but don't invent it. Confirmation bias is real! If diacetyl is a recurring issue for you, try performing a "D" test before packaging your beer.

How to Avoid: Pitch an appropriate amount of healthy yeast. If lagering, perform a diacetyl rest.

How to Fix: Krausen the beer.

Earthy - geosmin, soil-like, grassy

Active compound	2-Ethyl fenchol
Common sources	Packaging or water-derived contamination
Concentration	15 µg/L
Threshold in beer	5 µg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

Earthy, soil-like aroma which is mainly due to contamination, particularly water-based contamination. Other common descriptions are freshly dug soil or damp soil. Flavors reminiscent of chlorophyll and fresh cut grass occasionally occur and are most often linked to poorly stored ingredients. Poorly stored malt can pick up moisture and develop musty smells. Aldehydes can form in old malt and can contribute green grass flavors. Hops are another source of these green flavors. If the hops are poorly stored or not properly dried prior to storage, the chlorophyll compounds will become evident in the beer.

Causes: Packaging contamination or water derived contamination. Improperly stored grain and poor processing of hops can lead to formation of this off flavor. Specifically, aldehydes can form on malt when stored in a damp environment. More recently, high amounts of dry hopping have led to an increase of grassy and vegetal off flavors.

How to Detect: When tasting, look for the characteristic tastes and smells mentioned above. You'll find with beers that are highly hopped and served really fresh that they will burn or stick in the back of the throat. This is known as hop burn and goes hand in hand with some of these grassy, vegetal type off-flavors.

How to Avoid: Store grain in a cool and dry area. Use freshly milled grain. Use high quality hops and store them properly. Decrease dry hop addition amounts, time, and temperature.

How to Fix: If the issue is an overly vegetal beer from a lot of hops, giving the beer time for hop particulates and yeast to settle out will usually help take the edge off.

Round 2 Off Flavors:

Light Struck - skunky, toffee or coffee like

Active compound	3-Methyl-2-butene-1-thiol
Common sources	Clear or green bottles
Concentration	90 ng/L
Threshold in beer	5-30 ng/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

Misconceptions exist among beer drinkers regarding the cause of "skunky" beer. Some believe mistakenly that oxidation, stale hops and certain European-style yeast strains produce skunk-like notes, but the actual cause of skunked beer is much simpler. UV light splits isohumulone hop molecules in the beer, creating mercaptan chemicals like those in the scent glands of skunks. Brown glass protects beer from becoming light-struck and skunky, with cans and kegs offering ultimate protection. Clear or green glass bottles often lead to skunky beer, and even a glass of hoppy beer sitting in direct sunlight for just a minute or two will begin to smell like Pepe Le Pew. Skunky notes are never appropriate in any beer style.

Causes: A result of a reaction between riboflavin and alpha acids caused by sunlight and artificial light (fluorescent). Occurs in beers fermented or packaged in clear and green bottles.

How to Detect: Grab a bottle of TsingTao or Corona and you'll quickly become acquainted with this flavor. If present in a beer, it isn't (in my experience) subtle.

How to Avoid: Ferment and store beer away from light sources.

How to Fix: No known fixes. May decrease with aging.

Indole - farm, barnyard

Active compound	Indole
Common sources	Bacterial infection during fermentation
Concentration	0.55 mg/L
Threshold in beer	10-20 mg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

Indole is found in small quantities in all beer however it can be produced in larger, less desirable quantities by the coliform bacteria. Even if you can ignore the smell, it is best to dump the batch as it could lead to stomach ache or diarrhea. Around half of the population are very sensitive to Indole. The use of adjunct sugars or poor sanitization are

the most common causes for increased levels of Indole. Other aroma descriptions include fecal or baby diaper. This is often found in association with DMS.

Causes: This off-flavor is caused by coliform bacteria contaminating sugars and syrups. It can also occur during fermentation when bacteria are present. Indole commonly occurs with DMS and with DMTS it is perceived as a septic-like flavor. Bacterial infection during fermentation.

How to Detect: It will be a very distinct barnyard or farm-like smell.

How to Avoid: Be incredibly careful with contamination during the transfer and fermentation stages, especially of water.

How to Fix: Unable to fix once present.

Ethyl hexanoate - aniseed, apple or licorice

Active compound	Ethyl hexanoate
Common sources	Fermentation product, wort composition or yeast health
Concentration	0.6 mg/L
Threshold in beer	0.2 mg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

Ethyl hexanoate is produced by yeast during fermentation and imparts an apple-like flavor in beer. Too much Ethyl Hexanoate and the flavor profile will shift from positive to negative. This ester can lend a positive complexity to the appropriate beer style. But at higher levels, it is considered an off-flavor. Unlike ethyl acetate, our perception of it doesn't change at the high concentrations, it just becomes overwhelming and unpleasant. Some yeast strains produce more ethyl hexanoate than others, but regardless of the strain, other yeast management and fermentation attributes also impact its intensity – and whether its desirable or a detriment to enjoying the beer. Fermenting at higher temperatures tends to produce more ethyl hexanoate than at lower temperatures. Using a high pitching rate of yeast, in relation to the beer's original gravity, will restrain the production of ethyl hexanoate. Assuring that there is sufficient oxygen available to the yeast prior to fermentation impedes the production of ethyl hexanoate.

Causes: Fermentation of certain yeasts naturally produces some of this, but an abundance indicates a problem. In alcoholic beverages this flavor is caused by yeast fermentation and is common to many beers and beer brands. This flavor also occurs in non-alcoholic beverages; due to flavor carryover during bottling. Poor rinsing during product changeover or concentrated flavorings can be imparted to the final product.

How to Detect: A strong presence of aniseed, apple or licorice when it shouldn't be present.

How to Avoid: Be careful during fermentation and bottling stages. Sanitize everything carefully.

How to Fix: Once present, unable to fix.

Round 3 Off Flavors:

Papery - cardboard, oxidized

Active compound	Trans-2-nonenal
Common sources	Product of oxidation, staling
Concentration	2 µg/L
Threshold in beer	0.5 µg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

Why does beer lose much of its crispness and appeal after sitting on a shelf for an extended time? Oxygen in the sealed bottle or can reacts with certain compounds in the beer, producing unpleasant oxidation notes that the Beer Judge Certification Program (BJCP) describes as “a combination of stale, winy, cardboard, paper or sherry-like aromas and flavors.” This explains why brewers fret over levels of dissolved oxygen in packaged beer. Oxidation is never appropriate in most beer styles, but cellaring high-gravity, malty beers for a year or more often produces interesting sherry nuances and softer alcohol warmth. Oxidation rates increase dramatically when packaged beer is stored at room temperature, so keep beer refrigerated whenever possible.

Causes: Exposure to oxygen post fermentation. Oxidation occurs in every beer made but to many different degrees. Temperature and time are the two biggest factors. Warmer temps and more time will increase oxidation rates.

How to Detect: Arguably, most easily detectable in highly hopped beers that will present as dull and flabby as opposed to bright, bold, and hoppy. Oxidation can change in characteristic as aging occurs. It never does IPAs any favors.

How to Avoid: Purge kegs completely with CO₂. Avoid any open-air transfers if possible. When bottling, take special care not to splash, slosh, rouse or create foam in any way. Ideally, bottling would be done into a CO₂ purged bottle with a beer gun. Store beer at 50 F or cooler. Age beer only if appropriate for the style.

How to Fix: No fix.

Geraniol - floral, geranium flowers

Active compound	Geraniol
Common sources	Hop addition and variety
Concentration	450 µg/L
Threshold in beer	100-200 µg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

Geraniol comes from hops; it is an important character of hop oil and is the primary component in rose oil. It is generally described as rose-like, floral or citrus-like. About 67% of the population have a threshold of 350µg/l where the other 33% can perceive it at 18µg/l (450µg/l in Siebel sample). It is sometimes used as an insect repellent; however, it attracts bees. It is found in the following hops amongst others; Cascade, Citra, Centennial, Chinook, Sothern Cross and Styrian Goldings.

Geraniol, a compound closely associated with the aromatics of several favorite American hop varieties. It is essential oil found in some hop cultivars. Geraniol is classified as a monoterpenoid alcohol and is a primary component of rose oil, palmarosa oil, and citronella oil. In hops and beer flavor– related chemistry, it is characterized by rose-like, floral, and citrus fruitlike aroma and flavor. It is not found in UK Challenger, U. S. Challenger, Alsace Strisselspalt, Spalt Select, Sterling, Czech Saaz, Millennium, or German Magnum hops. Geraniol is also found in coriander, lavender, lemon, lime, nutmeg, orange, rose, blueberry, and blackberry. When oxidized, geraniol becomes geranial or citral. Interestingly, people have differing abilities to perceive geraniol; this difference is thought to be genetically based. One-third of the population has a perception threshold of about 18 µg/l, whereas the remainder of the population has a threshold of around 350 µg/l. Geraniol is also an effective repellent of mosquitoes and is used in many DEET-free repellent preparations. Victories in that regard may be pyrrhic, however, because geraniol is also an attractant of honeybees.

Causes: Hops or adjuncts

How to Detect: A strong aromatic presence.

How to Avoid: Be careful with the combination of hops and adjuncts used from the above list. Be careful to not allow oxidation when a floral presence is expected.

How to Fix: No known fixes once present.

Acetaldehyde - green apple, cut grass

Active compound	Acetaldehyde
Common sources	Fermentation product, staling or contamination
Concentration	45 mg/L
Threshold in beer	10-20 mg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

This little-known fermentation off-flavor manifests as a taste and aroma of green apples, freshly cut grass or even latex paint. Yeast cells typically convert acetaldehyde to ethanol during later stages of fermentation, but oxidation of the finished beer can produce additional acetaldehyde. Some wild spoilage bacteria can also create noticeable levels of the chemical in beer. Low levels of acetaldehyde found in certain Belgian and British ales can provide a pleasant nuance and

distinctive "house character." Classic examples would include many of the ales produced by Samuel Smith's Brewery in the U.K.

Causes: Acetaldehyde is a byproduct of fermentation. It is formed as a step in the production of alcohol. Oxidation can also lead to the formation of C₂H₄O post fermentation.

How to Detect: Look for true green apple flavors. Don't mistake this for apple-fruity esters. Sometimes tartness or sourness may also be falsely perceived as acetaldehyde.

How to Avoid: A healthy fermentation will allow the yeast to finish the job of converting acetaldehyde into ethanol. Take precautions against oxygen exposure post fermentation.

How to Fix: If you use kegs, try bubbling some Co₂ through the beer. A more involved but more effective method would be to krausen the beer.

Round 4 Off Flavors:

Metallic - metal, tin-like, blood

Active compound	Ferrous sulfate
Common sources	Water sources, non-passivated vessels
Concentration	3.75 mg/L
Threshold in beer	1 mg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

Metallic flavors are usually caused by unprotected metals dissolving into the wort but can also be caused by the hydrolysis of lipids in poorly stored malts. Iron and aluminum can cause metallic flavors leaching into the wort during the boil. The small amount could be considered to be nutritional if it weren't for the bad taste. Nicks and cracks ceramic coated steel pots are a common cause as are high iron levels in well water. Stainless steel pots will not contribute any metallic flavors. Aluminum pots usually won't cause metallic flavors unless the brewing water is alkaline with a pH level greater than 9. Shiny new aluminum pots will sometimes turn black when boiling water due to chlorine and carbonates in the water.

Causes: Exposure of boiling wort to unprocessed metallic surfaces while brewing (not including stainless steel). Water with a lot of iron and grain that isn't stored correctly are two more probable causes.

How to Detect: This one will be obvious. Metallic says it all.

How to Avoid: Test your water and avoid using water with high amounts of any metals. Use food grade brewing equipment.

How to Fix: No fixes. Metallic flavors will likely become more prominent with aging.

Isoamyl acetate - banana, peardrop, nail polish remover

Active compound	Isoamyl Acetate
Common sources	Fermentation product, wort composition or yeast health
Concentration	4.5 mg/L
Threshold in beer	1.0-1.5 mg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

This group of flavors is very similar to the alcohol and ester flavors, but are harsher to the tongue. These flavors often result from a combination of high fermentation temperatures and oxidation. They can also be leached from cheap plastic brewing equipment or if PVC tubing is used as a lautering manifold material. The solvents in some plastics like PVC can be leached by high temperatures.

Causes: Produced by *brettanomyces* is the presence of oxygen. Produced at some level by all yeast during fermentation. Can occur from fermented product, wort composition, or yeast health.

How to Detect: Isoamyl Acetate presents as fruity banana at low levels and isn't usually considered an off-flavor as such. In higher amounts, it reeks of nail polish remover. Easy to smell.

How to Avoid: When aging beer with brettanomyces, make sure to avoid excessive exposure to oxygen. Take steps to prevent high ester production with ale and lager strains. Also be very careful with sourcing your yeast.

How to Fix: Once it's there at high levels, it's there to stay.

Vanilla - custard powder, vanilla essence

Active compound	Vanillin
Common sources	Specific styles (barrel aged, common wood flavor)
Concentration	150 µg/L
Threshold in beer	40 µg/L
Exposure control	No specific measures for skin protection required. Avoid eye contact.
Disposal after use	Standard liquid waste disposal

Formed in some beers during ageing. Derives from breakdown of the barley cell wall materials. Can also be formed from the breakdown of certain phenolic compounds produced by wild yeasts. Vanilla imparts a positive aroma to some beer styles. Custard like, Cream soda or Ice cream.

Causes: The main causes are poor attenuation by yeast or a stuck fermentation. It is possible that a poorly designed recipe could be the culprit as well. Can also occur during barrel-aging. Specific styles may have it as a desired phenol flavor compound, or wild yeast can also present it (desired or undesired).

How to Detect: A lot of beers have an element of sweetness that is appropriate. It is important to be familiar with the style of beer before determining that it is inappropriately sweet. That said, when sweetness is an off flavor, it is obvious. We're all very well acquainted with the flavor so detecting it is easy!

How to Avoid: There are many reasons yeast don't attenuate as far as they should. To avoid stalled fermentations and poor attenuation, pitch a proper amount of healthy yeast. Take the time to make a starter if necessary. Make sure your wort is adequately oxygenated when you pitch your yeast. Control your fermentation temp if possible.

How to Fix: If the issue is a stuck fermentation, take steps to help the yeast finish the job.