



# “Off” Flavors In Beer

## Their Causes & How To Avoid Them

A MoreManual™

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### Acetaldehyde

- **Tastes/Smells Like:** Green apples, rotten-apples, freshly cut pumpkin.
- **Possible Causes:** Acetaldehyde is a naturally occurring chemical produced by yeast during fermentation. It is usually converted into Ethanol alcohol, although this process may take longer in beers with high alcohol content or when not enough yeast is pitched. Some bacteria can cause green apple flavors as well.
- **How to Avoid:** Let the beer age and condition over a couple months time. This will give the yeast time to convert the Acetaldehyde into Ethanol. Always use high quality yeast and make sure you are pitching the correct amount for the gravity of the wort or make a yeast starter.

### Alcoholic

- **Tastes/Smells Like:** Overpowering alcohol flavor, bitter, acetone, paint thinner, spicy, sharp, undesirable “hot” sensation in the throat
- **Possible Causes:** Fusel alcohols such as propanol, butanol, isobutanol, and isoamyl alcohol as well as phenolic alcohols such as tyrosol are usually responsible for unpleasant alcohol flavors. Limited amounts of these alcohols can be desirable in high alcohol beers such as barley wines or strong ales and are much more noticeable in lighter style beers. The most common source for such alcohols is fermenting at too high of a temperature, however, keeping beer on the trub for too long or oxidation can cause this as well.
- **How to Avoid:** Avoid fermenting at temperatures exceeding 80°F. If the beer is going to be sitting in the fermenter for longer than a couple weeks, it is a good idea to remove as much sediment from the wort as possible before transferring it to the fermenter. A secondary fermenter can also be used to help reduce the amount of contact time the beer has with the trub.

### Astringent


- **Tastes/Smells Like:** Tart, vinegary, tannin, drying,

puckering sensation, may feel powdery or metallic in the mouth, like sucking on a grape skin or a tea bag

- **Possible Causes:** Astringency can be caused by many different factors. Polyphenols or tannins are the number one cause of such flavors. Tannins are found in the skins or husks of the grain as well as in the skin of fruit. Steeping grain for too long or grain that has been excessively milled or crushed can release tannins. When mashing, if the pH exceeds 5.2–5.6, astringent flavors can be produced. Over-hopping can also lend a hand in creating astringent qualities.
- **How to Avoid:** Avoid grain that has been “over-milled”. Grain should be cracked open but not crushed or shredded. When sparging, pay close attention to the temperature and the amount of the water used. When steeping grains, be sure to take them out before the water gets to a boil. Fruits should never be boiled in the wort; instead, they can be added to the fermenter or to water that is hot but not boiling for 15–30 minutes. Make sure that the amount and varieties of hops used are the correct types for the style of beer.

### Chlorophenol

- **Tastes/Smells Like:** Plastic, Vinyl, Iodine
- **Possible Causes:** Using chlorinated tap water to brew or rinse equipment is the most common cause for plastic-like or medicinal flavors. Medicinal flavors can also be the result of using cleanser or sanitizer that is chlorine or iodine based. Some wild yeast will contribute to a similar medicinal taste.
- **How to Avoid:** Don’t use chlorinated water to brew or to rinse equipment that will come into contact with the beer. If chlorinated water must be used, use a water filter that removes chlorine or boil the water for 15 minutes and then cool to room temperature to force out any chlorine that may be present. Always use the recommended amount and concentrations of sanitizers. Most sanitizers will not cause any off flavors when used properly. When using bleach, use one-half ounce per gallon of water, let equipment



soak for 10 minutes and always rinse with sanitized (pre-boiled) water.

## Cidery

- **Tastes/Smells Like:** Apple Cider, Wine, Acetaldehyde (apples)
- **Possible Causes:** Using too much corn or cane sugar is the most common cause for wine or cidery flavors. Generally, 1 lb of sugar per 5 gallon batch is considered the limit before cidery flavors start developing. Acetaldehyde can also give off a cider-like quality.
- **How to Avoid:** Try cutting down on the amount of corn or cane sugar being used. Using an alternate source of fermentable sugar can help to reduce cidery or winery flavors. Dried or Liquid malt extract will not give off any cider flavors. Honey is another good substitution as it is almost fully fermentable but it will leave a slight to strong honey aroma and taste depending on how much is used. If the cause is the yeast rather than cane or corn sugar, lagering may help cidery flavors to dissipate over time.

## Diacetyl


- **Tastes/Smells Like:** Butter, Rancid Butter, Butter-scotch, Slickness in the mouth and tongue
- **Possible Causes:** Diacetyl is naturally produced by all yeast during fermentation and is then “reabsorbed” by yeast cells. Increased diacetyl or diacetyl that is not reabsorbed may be a result of high flocculating yeast, weak or mutated yeast, over or under oxygenating, low fermentation temperatures and weak or short boils. It is generally regarded as a flaw when detected in lagers. Some brewers, and drinkers alike, desire small amounts in ales.
- **How to Avoid:** Taking the following steps will help yeast to properly reabsorb diacetyl in wort: Yeast that is highly flocculant may fall out of suspension before it gets a chance to absorb the diacetyl, using medium flocculation yeast should give the yeast a good chance to absorb diacetyl. Always use high quality yeast and avoid weak or possibly mutated strands that may be incapable of handling diacetyl properly. Allow yeast to begin initial growth with the use of a yeast starter. Supply sufficient oxygen for yeast growth, but avoid over oxygenating especially after pitching yeast. Allow enough time for yeast to fully ferment at appropriate temperatures.

## Dimethyl Sulfide (DMS)

- **Tastes/Smells Like:** Cooked vegetables, especially creamed corn, cabbage, tomato, shellfish/oyster-like flavors
- **Possible Causes:** S-methyl methionine (SMM) is created during the malting process of grain and is later converted to DMS when heated. Darker base grains have less DMS as the kilning process converts SMM to DMS and drives it off before going into the wort. This makes DMS naturally more prevalent in pale ales and lagers.
- **How to Avoid:** When boiling wort, DMS is driven off through evaporation. It is very important to always maintain a strong rolling boil for at least one hour. Some brewers boil for 90 minutes to ensure that as much DMS is driven off as possible. Avoid letting condensation drip back into the wort and never cover your kettle completely during the boil. Long cooling times can also lead to excess amounts of DMS. Cool your wort to pitching temperature as quickly as possible with a wort chiller or ice bath. Finally, a strong fermentation with lots of Co2 production helps to clean up DMS since the bubbles carry DMS away, so pitching high quality yeast is a must.

## Estery/Fruity

- **Tastes/Smells Like:** Fruit, especially banana, to a lesser extent, pear, strawberry, raspberry, grapefruit
- **Possible Causes:** Esters are a naturally occurring by-product of fermentation. Certain ales are supposed to have these fruity flavors, such as Belgian ales and Hefeweizens (German Wheat beer) and certain types of yeast produce more esters than others. Strong fruity flavors or fruity flavors that are inappropriate for the style of beer are sometimes a result of under pitching or high fermentation temperatures. As a general rule, the higher the fermentation temperature, the more esters the yeast will produce. In addition to high fermentation temperatures, low oxygen levels can also help increase the production of esters.
- **How to Avoid:** Always pitch enough yeast for the gravity of your beer and oxygenate well. Keep fermentation temperatures under 75°F when possible. Fermenting over 75°F has been shown to drastically increase esters. Fermenting between 60°F–65°F will reduce ester production considerably, however, be prepared for a slower fermentation. Lastly, always use the correct yeast for the style of beer being brewed. Yeast strains



made for Belgian or German wheat beers are made to produce fruity characteristics, so if you are trying to avoid beers that taste like bananas, avoid using these strains.

## Grassy

- **Tastes/Smells Like:** Freshly cut grass, musty,
- **Possible Causes:** Musty, grassy aromas and flavors are usually the result of grains or extract that have developed mold or bacteria prior to being used. Aldehydes can occasionally form on old malt, which can lead to a grassy flavor. Hops, if not processed correctly prior to packaging/storing, can also develop similar off flavors.
- **How to Avoid:** Always store grains or extract in a cool, dry, dark place. Check ingredients for discoloration, off smells or tastes, prior to brewing. Milling grain just prior to brewing will help to keep it fresh. Pre-milled grain should be used in 2–4 weeks from the time it is milled. Always use high quality hops. If using homegrown hops, make sure to properly cure them before long-term storage. As a general rule, if ingredients look, smell and/or taste good, they should be fine to use.

## Husky/Grainy

- **Tastes/Smells Like:** Raw grain, dry, flavors comparable to astringency from tannins and/or oxidization
- **Possible Causes:** Over milled grain can cause husky, grainy off flavors. Highly toasted malts can also contribute to husky, grainy qualities. These flavors are most common in all-grain brews due to the amount of grain being used and the need to mash and sparge.
- **How to Avoid:** Following the same precautions to avoid astringency should help with any grainy or husky flavors. Avoid grain that has been shredded or crushed. When using homemade toasted grains, allow them to age for 1–2 weeks after milling to allow harsh aromas and flavors to dissipate. Cold conditioning a husky or grainy tasting beer will usually help the off flavors to fall out of suspension.

## Medicinal

- **Tastes/Smells Like:** Cough syrup, mouthwash, Band-Aid™, smoke, clove-like (spicy)
- **Possible Causes:** A variety of different phenols are almost always the cause for medicinal flavors in beer. Phenols can cause solvent, astringent, plastic and

medicinal flavors. Medicinal-tasting phenols are usually brought out during mashing and/or sparging and are caused by incorrect pH levels, water amounts and temperatures. Using chlorine or iodine-based sanitizers improperly can bring out Chlorophenols. Yeast also produces phenols, and a clove-like characteristic is deliberate in some ale, especially Hefeweizen and other wheat beers.


- **How to Avoid:** Follow proper mashing and sparging techniques and always follow the specific directions for different sanitizers. Taking the same precautions to avoid Chlorophenols and astringency should help to wipe out the chances of medicinal flavors. Always use the proper yeast for the style of beer being brewed.

## Metallic

- **Tastes/Smells Like:** Metal, mainly iron, also described as tasting like pennies or blood, Felt on the front of the mouth and back of the throat
- **Possible Causes:** Wort being boiled in unprocessed metals, mainly iron, but also aluminum, and steel (excluding stainless) is usually the source of metallic flavors. Metallic flavors can also be extracted from metal brewing equipment, bottle caps and/or kegs. Using water that has high levels of iron will impart iron flavors. Improperly stored grains can also cause metallic off flavors.
- **How to Avoid:** Use stainless steel pots and brewing equipment (fittings, spoons, etc.) when possible. Avoid using iron for anything that will be coming in contact with beer/wort. If using a ceramic coated steel pot, always check for cracks or scratches before using. Stainless steel will not give off any metallic flavors. Aluminum pots will generally only cause metallic flavors when using alkaline water with a pH over 9. If using an aluminum pot, you can “bake” the pot in an oven at 250°F for 6 hours to increase the protective oxides. Always use fresh, properly stored grain. Avoid using water with iron in it, such as unfiltered well water.

## Moldy

- **Tastes/Smells Like:** Mold, mildew, musty, like mold on bread
- **Possible Causes:** Mold can grow in beer and wort and is almost always the result of storing fermenting beer in a damp, dank area. Using extract or grain that has developed mold can impart moldy, mildewy flavors as well.

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- **How to Avoid:** Always store your fermenter in a dry, dark place. Avoid storing your fermenter in damp, dank or humid surroundings. Check all ingredients for off smells, flavors and/or discoloration prior to brewing with them. Discard any moldy grain. If mold is found in malt extract, it is recommended that it be thrown out. Moldy extract can still be used if the mold is scraped off but be prepared for off flavors in the final product. If mold is found in the fermenter or beer, it is possible to save the batch by scraping off as much mold as possible. However, by the time mold is seen, it has usually infected the entire fermenter.

## Oxidation

- **Tastes/Smells Like:** Stale or old, wet cardboard, sherry, papery, pineapple, decaying vegetables, Increased bitterness, harshness
- **Possible Causes:** Oxidation occurs when oxygen negatively reacts with the molecules in the wort or beer. An excessive level of oxygen being introduced to the beer, especially while wort is still warm or after fermentation is complete, can create cardboard or sherry-like flavors. Too much headspace in bottles can lead to oxidation as well. On the other hand, aeration of wort before pitching yeast is necessary for yeast and good fermentation.
- **How to Avoid:** Oxidation is almost always a result of unnecessary splashing of fermented beer. When transferring beer from one vessel to the next, prevent splashing by transferring beer with tubing rather than pouring straight in. Keep the end of the transfer tubing beneath the liquid line and avoid getting air pockets in the transfer tubing. Also, keep exposure of wort to outside air at a minimum. Hot side aeration refers to wort becoming oxidized while it is hot. Warm liquid is more inclined to absorb oxygen and therefore, it is recommended that when wort is over 80°F, splashing be avoided. During and directly after the boil splashing is not much of a concern, as oxygen can't really dissolve into liquid that hot. Cool wort as quickly as possible and do not aerate wort until it is under 80°F. When bottling, only leave about ½" of headspace. The use of "oxygen absorbing" bottle caps may help keep oxygen out of the bottle. When kegging, purge kegs with CO<sub>2</sub> to flush oxygen out of the headspace.

## Salty

- **Tastes/Smells Like:** Salt, detected on the front sides

of the tongue

- **Possible Causes:** Adding too much gypsum or Epsom salt can create an overly salty beer.
- **How to Avoid:** Never add brewing salts to your water unless you know the original salt content of the water, how the salts will effect the water you are using and how much to use. Certain beers are known for their slightly salty nature such as beer from Burton-on-Trent.

## Skunky


- **Tastes/Smells Like:** Aroma of skunk, musty, can be similar to burned rubber or cat musk
- **Possible Causes:** When hops are exposed to UV rays from sunlight or florescent lights, the alpha acids breakdown and react with the hydrogen sulfide that the yeast make. This reaction creates mercaptan. Mercaptan is the same chemical skunks secrete when they spray which is why the smell of "light struck" beer is so similar to that of a skunk.
- **How to Avoid:** When fermenting beer in a clear container, always keep it out of any direct sunlight or florescent lamps. A simple paper bag or towel wrapped around the carboy will help to keep light out. All clear containers will let UV light in, however, brown bottles will filter a majority of UV rays and help to keep your beer "skunkless" for longer. Avoid green or clear bottles as these let almost all UV light in. Light-colored beers and beers with a lot of hops are more prone to becoming skunky. Dark beers and beers that utilize isomerized hop extracts are less susceptible to becoming light struck.

## Soapy

- **Tastes/Smells Like:** Soap, detergent, oily, fatty
- **Possible Causes:** Keeping beer in the primary fermenter for a long time after fermentation is complete can cause soapy flavors. After a while, the fatty acids in the trub start to break down and soap is essentially created.
- **How to Avoid:** Transfer beer into a secondary if you plan on aging it in the fermenter for a long period of time. Very light beers and lagers are more susceptible to absorbing and exhibiting off flavors than ales and darker beers.

## Solvent-Like

- **Tastes/Smells Like:** Paint thinner, nail polish remover



(acetone), harsh, sharp, in extreme cases can cause a burning sensation of tongue and throat, comparable to harsh alcohol or estery flavors.

- **Possible Causes:** Solvent-like flavors and aromas are usually due to a combination of very high fermentation temperature and oxidation of the beer. Similar flavors can also result from using plastic that isn't food grade.
- **How to Avoid:** Avoid fermenting at temperatures higher than the suggested range for the yeast being used. Avoid oxidation of beer. Never use plastic or vinyl equipment that is not marked as food grade. Some food grade plastics leach toxins after reaching a certain temperature. If plastic parts will be exposed to hot liquids or high temperatures, check the temperature rating with the supplier or manufacturer.

## Sulfur/Hydrogen Sulfide

- **Tastes/Smells Like:** Sulfur, burning match, rotten egg, raw sewage
- **Possible Causes:** Hydrogen sulfide, which is the chemical responsible for giving sulfur its unpleasant smell, is naturally produced by all yeast during fermentation. Many lager yeasts can create overwhelming sulfur-like aromas. Ale strains generally make such small amounts that the odor is unnoticeable.
- **How to Avoid:** During fermentation, the production of hydrogen sulfide is inevitable. CO<sub>2</sub> will carry most of the hydrogen sulfide away. Conditioning or lagering after primary fermentation is complete should make any left over sulfur smells or tastes fade over time.


## Sour/Acidic

- **Tastes/Smells Like:** Vinegary, acrid, felt on the sides of the tongue towards back of the mouth
- **Possible Causes:** Extremely sour or vinegary flavors are almost always the result of a bacterial or wild yeast infection. Lambic style beers are beers that have been purposely exposed to specific types of wild yeast and bacteria to create the unmistakable cidery and sour flavors they are known for.
- **How to Avoid:** Bacteria and wild yeast are in the air, all around us, all of the time. Commonly referred to as “nasties” in the brewing world, these bacteria and yeast only fall downward – they will not crawl up an in. Make sure to thoroughly sanitize everything and anything that will be coming into contact with beer

post boil. Cover your kettle when cooling your wort. Wort or beer that is under 180°F is prime breeding ground for bacteria and wild yeast. Dirt cannot be sanitized so clean equipment prior to sanitizing if it is visibly dirty. If using a plastic fermenter check it for any scratches, as these are a great place for bacteria to hide. Only open the fermenter when necessary. Use high quality yeast and/or make a yeast starter. The faster the yeast starts to ferment, the more likely they will over power or push out any nasties. Proper sanitation is one of the most important things when it comes to making great home brew!

## Sweet

- **Tastes/Smells Like:** Overly sweet or sugary, sweet wort, cloyingly sweet
- **Possible Causes:** Some degree of sweetness is desired in most beers, but a beer that tastes like unfermented wort is most likely the result of the yeast quitting prematurely. Stuck fermentation is when the yeast ferments for several days and then suddenly stops. The result is a gravity that is much higher than the correct final gravity for the wort. Using yeast that doesn't have a high tolerance for alcohol in a high gravity beer can leave too much residual sweetness. A sudden drop in temperature can cause yeast to go dormant and stop fermenting. Also, beer that is lacking the right amount of hop bitterness can cause an unbalanced sweetness. Unbalanced sweetness is often described as “cloyingly sweet”. Using too much fruit flavoring or other adjuncts can cause a sickly-sweet beer as well.
- **How to Avoid:** Always use high quality yeast and make sure you are pitching the correct amount for the gravity of the wort or make a yeast starter. Use the proper strain of yeast for the style of beer being made. Highly flocculant yeast can sometimes fall out of suspension before fermentation is over, however pitching enough yeast will usually prevent this. If you are aiming for a dry, less sweet beer, use yeast with a high attenuation percentage. If making a beer with very high alcohol content, it is very important to use yeast nutrients. Monitor fermentation temperatures and avoid fermenting lower than the suggested temperature range. It is possible to revive dormant yeast by gently swirling the fermenter and gradually raising the temperature. Otherwise, pitching more yeast is another option. When formulating recipes, keep in mind that you can highlight a sweet or bitter taste,



but the balance of flavors is what makes a beer enjoyable. If using fruit extracts or flavoring, start with a little and add more to taste.

## Yeasty

- **Tastes Like:** Yeast, bready, can be harsh or slightly sulfur-like
- **Possible Causes:** Unhealthy or mutated yeast can release “yeasty” flavors into beer. If beer is left sitting on dead yeast for a long period of time, dead yeast starts to essentially “eat” itself (*autolysis*) and harsh or sulfury flavors are released. Young beer can taste yeasty if the yeast has not had a chance to flocculate completely. Yeasty flavors can also be a result of pouring yeast when serving from a bottle.
- **How to Avoid:** If a beer such as a lager is going to be kept in a fermenter for a long period of time, using a secondary vessel is recommended. Always leave a majority of the trub in the primary fermenter when racking to a secondary fermenter, bottling bucket or keg. Some yeast sediment is unavoidable when carbonating in the bottle. If yeast sediment is present leave the last inch or so of beer in the bottle when pouring.

## A Note on Sanitation:

Proper sanitation is often said to be the most important thing when it comes to making great homebrew. A perfectly crafted and flawlessly brewed beer can turn into an unpalatable mess if it is exposed to wild yeast or bacteria. Bacteria and wild yeast can generate almost every off flavor listed above. If your beer develops a funky flavor and none of the referenced troubleshooting tips take care of the problem, you are probably dealing with an infection. Always practice good sanitation techniques and be sure to sanitize anything and everything that will be coming into contact with the wort or beer.

Unfortunately, not much can be done to salvage a contaminated batch, but you can learn from it. If your beer becomes an unlucky victim of the nasties, evaluate your sanitation techniques and try again.