

Off Flavors - A Deeper Look At What Causes Certain Off Flavors and How To Prevent Them

Every beer is made up of a complexity of flavors and everyone perceives this flavor-makeup differently. You may find you really enjoy a certain beer, while another person may find that same beer to be awful tasting. Each individual has higher sensitivities to certain flavors, creating a unique standard of what is found to be pleasant or abhorrent; but, in general, there is a set of flavors that are considered “off” or faulty when found at a certain level (or any level) in beer. Some of these flavors are present in almost all beer to some degree and considered an “on” flavor except when its level gets too high for a given style (fruity esters). Other off-flavors are less frequently found, but still are appropriate in small quantities in specific styles (a buttery flavor in some lagers). Then there are those that are never appropriate no matter their level or the beer style (baby vomit). Learning to recognize, then control, or eliminate these off-flavors appropriately takes time and practice.

We had a chance to experience 6 different off flavors (contamination, D.M.S., diacetyl, isovaleric acid, papery, and H₂S); but only briefly hit on what causes them. In this handout we will take a closer look at what causes those off flavors we tasted and how to prevent them.

It is important to know that cause and control of flavors go hand in hand. Once you have learned what causes a given off flavor in your beer you can better manage your brew day and beer handling to either control or eliminate the cause. The causes of different flavors should be purposely taken into consideration and accounted for by the brewer at the very least in the broad picture of things. Since half of brewing is art, any accidental flavors are “off”, at least until the brewer decides they're not.

Some off flavors, especially those resulting from contamination, are almost always going to be considered faulty. These off flavors are usually caused by poor sanitation and, less often, by poor brewing practices. Any off flavors not arising from contamination are always a result of your brewing practice, such as uncontrolled fermentation temperatures, waiting too long to rack to a secondary, weak boils, poor bottling technique, or simply choosing the wrong yeast.

The following chart looks at 6 common off flavors, the source of those off flavors, and how to control them.

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Off Flavor Name	Flavor Description	Common Sources/Causes	How To Avoid/Control
<p style="text-align: center;">Contamination</p>	<p>Sour and Buttery, Tart, Citrusy, Peppery/Burning Mouthfeel</p> <p>(All beers are acidic to some degree, but it becomes an off flavor if it is at too high a level overall or too high for a given style. Sourness at different levels can be appropriate to dry stouts, Belgian sours, <u>Berliner weisse</u>, <u>Fruit beers</u>, <u>Goses</u>, <u>Witbier</u>, and Wild Ales.)</p>	<ul style="list-style-type: none"> • Any perceived sourness is due to added acids in the form of raw materials (i.e. fruit), fermentation, and/or bacterial contamination or inoculation. • Yeast contributes some natural acids during fermentation. It can also be caused by certain brewing practices. 	<ul style="list-style-type: none"> • Practice proper sanitation. • Choose a yeast strain appropriate to the style. • Don't mash for longer than two hours. • Pitch the right amount of healthy yeast to minimize lag time. • Avoid high temperature fermentations. • Don't contaminate your siphon by sucking to start the flow, instead use an auto-siphon. • Replace plastic brewing supplies and equipment, especially fermentors, when they become scratched as scratches can hide bacteria. (Alternatively, use glass carboys or stainless steel.) • Limit acidic fruit and additions of acidulated malt and lactic acid. • If sour mashing, avoid oxygenating and keep it above 130°F.

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D.M.S.	<p>Cooked/Creamed Corn, Cabbage, Cooked/Canned Vegetables</p> <p>(Considered an off flavor in most beer, but can play some role in the flavor profile of some pale lagers, German and American pilsners, and cream ales.)</p>	<ul style="list-style-type: none"> • DMS comes from a sulfur-based organic compound (S-methyl methionine, or SMM) which is produced when grain germinates during the malting process. (Six row lager malts and Pilsner malts have the highest levels of this compound. As do some adjunct grains such as corn.) SMM changes to DMS during the boil. • It can also come from wild yeast or bacterial contamination during fermentation. <p>(May decrease with aging.)</p>	<ul style="list-style-type: none"> • Reduce use of pilsner malts, lager malts, and corn adjuncts. • Higher moisture content in malt increases the SMM, so make sure you store your malt in a dry, cool place. • Over-sparging can increase DMS. • DMS is a volatile compound and the easiest way to get rid of it is to drive it off with a vigorous boil. Always use a big enough kettle to allow for an energetic boil without having to worry about boil over. And always leave the lid off! • Ensure your vigorous boil is long enough. Boil for at least 60 minutes and, if using lager or pilsner malt, consider upping it to 90 minutes. • Also try your best to crash cool your boiled wort as quickly as possible. DMS is produced at warm non-boiling temperatures, so you don't want to leave your wort in that temperature-range long. • As always, practice good sanitation.
Diacetyl (2,3-Butanedione)	<p>Butter, Butterscotch, Milky, Oily</p> <p>(It is usually considered an off flavor, but is appropriate at low levels in some styles, including English Bitters, Scotch Ales, Dry Stouts, and Czech Pilsner to name a few.)</p>	<ul style="list-style-type: none"> • It is produced by all yeast during fermentation, but is usually reabsorbed by the yeast cells. • Non-reabsorption or over production is caused by feeble or short boiling, low temperatures during fermentation, mutated yeast, or racking too soon. It can also be formed by bacteria contamination. <p>(Diacetyl can become more pronounced over time in packaged beer that has the precursor of diacetyl, alpha acetolactate. As the alpha acetolactate breaks down it forms diacetyl. Heat accelerates this breakdown.)</p>	<ul style="list-style-type: none"> • Always boil vigorously for the appropriate amount of time. • Aerate your fermentation well when you cast your yeast and avoid oxygenating the wort further once fermentation has begun. • Up your temperature slightly as you near the end of fermentation as this helps the yeast reabsorb diacetyl. • Don't be too quick to rack your young beer off the yeast to ensure the yeast is done doing their work before you move your beer off of the yeast.

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<p style="text-align: center;">Isovaleric Acid</p>	<p>Cheesy, Old Hops, Sweaty Socks</p> <p>(Is sometimes a component of some highly hopped beer styles, but in general is considered an off flavor.)</p>	<ul style="list-style-type: none"> • A result of oxidation of the alpha acids in hops and may be confused as being caprylic, another off flavor. If associated with alpha acids, it is often accompanied by grassy notes, but it can also be caused by bacterial infection. <p>(Will mellow with age.)</p>	<ul style="list-style-type: none"> • Use fresh hops and ensure you buy fresh hops that have been stored correctly. • Store hops in a freezer in a oxygen free, vacuum sealed container or bag. • Age beer that has cheesy notes to help mellow those flavors. • Use good sanitation practices.
<p style="text-align: center;">Papery</p>	<p>Cardboard, Oxidized, Old Book</p> <p>(This is a flavor associated with the aging process of beer. What qualities it takes on depends on the style of beer and what temperature the beer is stored at. Some flavors associated with oxidation are important components of an aged beer's profile, others, are always considered off flavors.)</p>	<ul style="list-style-type: none"> • Oxidation is directly caused by aging. How fast and to what extent this process occurs is a result of oxygen conditions, storage temperatures, and a beer's ingredients. The more oxygen a beer is in contact with the faster and more severe the oxidation. Cooler storage temperatures slow the process. There is a marked increase in oxidation as storage temperature increases. Ingredients used in the beer can both inhibit or aid oxidation. <p>(Oxidation characteristics are very fluid. Some flavors will increase; some will increase then decrease or level off.)</p>	<ul style="list-style-type: none"> • Minimize aeration of hot wort by avoiding splashing, spraying, or vigorously stirring. • Do not aerate beer after fermentation starts. • Work to get good hot and cold break separation. • Don't leave more than 1 to 2 inches of head space when bottling. • Use ant-oxidant bottle caps and cap on foam if possible. • When possible, purge kegging equipment with CO2 before using. • Keep beer below 50°F if cellaring. • Don't age beer unless it's meant to be aged.

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<p>H₂S</p>	<p>Rotten Eggs, Sulfury, Sewer</p> <p>(Small quantities can give freshness to beer, but it quickly becomes an off flavor as the quantity increases.)</p>	<ul style="list-style-type: none"> • All yeast strains produce some amount of hydrogen sulphide during fermentation, but production can be increased when yeast are stressed. • Other possible causes are bacterial infection and yeast autolysis. <p>(The quantity of H₂S may increase with maturation after packaging.)</p>	<ul style="list-style-type: none"> • Give your beer enough time. Ale fermentations are vigorous and much of the hydrogen sulphide is scrubbed out by released CO₂. Lager yeasts will produce more H₂S and the fermentation tends to be much mellower. If a lager fermentation is done, but still smells sulfury chances are it needs some more maturation time before bottling. • Select your yeast strain with care. Ensure you cast enough healthy yeast and oxygenate the wort well. Consider using a yeast nutrient to up the zinc content in the wort. • Get the beer off of the yeast cake and into a secondary as soon as fermentation is complete. • Ensure your sanitation practices are up to snuff so that you can take bacterial contamination off the list of possible causes.