

Beer Off Flavors



Off flavor	Diacetyl (2,3 butanedione)
Flavor Threshold	0.1 – 0.2 mg/L
Tastes Like	buttery, butterscotch, popcorn artificial butter, slick mouthfeel
Cause(s)	Yeast produce α -acetolactate, which leaks into beer, where it's oxidized to diacetyl. Nutrient (valine) deficiency can increase α -acetolactate. Also produced by pediococcus / lactobacillus / (brettanomyces) contamination.
How to Fix	<ul style="list-style-type: none"> - Diacetyl is normally absorbed by yeast - Krausening with fresh active yeast can reduce
How to Avoid	<ul style="list-style-type: none"> - Allow enough time in fermenter (including after dry hopping (hop creep)) before crashing yeast - Diacetyl rest can accelerate production and absorption - "Appropriate" nutrient levels - Forced diacetyl test - Sanitation



Off flavor	Acetic Acid
Flavor Threshold	60 – 100 mg/L
Tastes Like	vinegar, sour
Cause(s)	Contamination by: <ul style="list-style-type: none"> - Acetobacter (& oxygen) - Lactobacillus (& (sometimes) oxygen) - Brettanomyces (& oxygen)
How to Fix	n/a
How to Avoid	<ul style="list-style-type: none"> - Sanitation - Avoid post fermentation Oxygen - Adequate Hopping can suppress Lactobacillus (variable by strain)



Off flavor	Diacetyl & Acetic Acid combo
Flavor Threshold	0.1 – 0.2 mg/L & 60 – 100 mg/L
Tastes Like	rancid butter, sour cream, buttermilk
Cause(s)	When found together, the most likely cause is Lactobacillus contamination, or multiple microbes contamination.
How to Fix	n/a
How to Avoid	<ul style="list-style-type: none"> - Sanitation - Avoid post fermentation Oxygen - Adequate Hopping can suppress Lactobacillus (variable by strain)



Off flavor	DMS (Dimethyl Sulfide)
Flavor Threshold	25 – 50 µg/L
Tastes Like	creamed corn, cooked corn, cooked vegetable, oysters, tomato juice, vegetal
Cause(s)	<ul style="list-style-type: none"> - Inadequate boil-off of DMS produced from thermal degradation of precursor S-methyl methionine (SMM) during boil or hopstand. SMM comes from malt, esp. lightly kilned malts. - During ferment, yeast can reduce precursor dimethyl sulfoxide (DMSO, also from malt) to DMS - Contamination: Enterobacter and others can also convert DMSO to DMS
How to Fix	n/a
How to Avoid	<ul style="list-style-type: none"> - Adequate boil vigor and times, longer for pilsner malts - Use higher kilned malts (e.g. pale ale malt vs. pilsner) - Sanitation



Off flavor	Papery/Oxidized (Trans-2-nonenal)
Flavor Threshold	0.1 – 0.25 µg/L
Tastes Like	papery, wet cardboard, stale, cucumber
Cause(s)	<ul style="list-style-type: none"> - Enzymatic oxidation of lipids by Lipxygenase (LOX), both from malt - Non-enzymatic oxidation of linoleic acid (from malt)
How to Fix	n/a
How to Avoid	<ul style="list-style-type: none"> - Avoid Oxygen other than at yeast pitch - Vorlauf (i.e. clear wort into kettle) - Consider using a LOX-less base malt - Keep beer cold



Off flavor	<h1>Acetaldehyde</h1>
Flavor Threshold	10 – 20 mg/L
Tastes Like	green (unripe) apples, cut grass, solventy
Cause(s)	<ul style="list-style-type: none"> - Produced by yeast during the fermentation of glucose (second to last step in the production of ethanol) - Incomplete Fermentation - After fermentation: Oxidation of ethanol to acetaldehyde
How to Fix	<ul style="list-style-type: none"> - Extend time on yeast before packaging
How to Avoid	<ul style="list-style-type: none"> - Pitch enough healthy yeast cells - Aerate wort - Don't rush to packaging - Avoid Oxygen other than at yeast pitch



Off flavor	Skunked/Lightstruck (3-methyl-2-butene-thiol)
Flavor Threshold	5 – 30 ng/L
Tastes Like	skunk, sulfury
Cause(s)	<ul style="list-style-type: none"> - Produced by light striking Isohumulones from hops 350 – 500 nm wavelength, i.e. Ultraviolet/Blue/Green - Catalyzed by Riboflavin (produced by yeast)
How to Fix	n/a
How to Avoid	<ul style="list-style-type: none"> - Avoid light after pitching yeast - Use brown bottles - When outdoors, drink fast (but responsibly)



Off flavor	Lactic Acid
Flavor Threshold	200 – 400 mg/L
Tastes Like	tart/sour
Cause(s)	Contamination by: <ul style="list-style-type: none"> - Lactobacillus - Pediococcus - some other gram positive bacteria
How to Fix	<ul style="list-style-type: none"> - Add Baking Soda or Pickling Lime to finished beer (raises pH)
How to Avoid	<ul style="list-style-type: none"> - Sanitation - Adequate hopping (iso-α-acids inhibit Lactobacillus)



Off flavor	Metallic
Flavor Threshold	1– 2 mg/L
Tastes Like	iron, rusty, blood, aluminum foil
Cause(s)	<ul style="list-style-type: none"> - Rusty Pipes/Equipment - Bare Aluminum - H₂O with High Iron Content
How to Fix	n/a
How to Avoid	<ul style="list-style-type: none"> - Bring plumbing up to code - Passivate Stainless Equipment - Boil Water in Aluminum Kettles before first use - Brew with RO/Distilled water vs high iron well water



Off flavor	Isovaleric Acid
Flavor Threshold	0.1 – 1.5 mg/L
Tastes Like	cheesy, gym socks
Cause(s)	<ul style="list-style-type: none"> - Oxidation of Hop Resins - Brettanomyces contamination
How to Fix	<ul style="list-style-type: none"> - If caused by Brett (or if Brett is simply present), aging may allow Brett to break it down into ethyl isovalerate, a berry-like ester.
How to Avoid	<ul style="list-style-type: none"> - Store hops cold, vacuum sealed/nitrogen flushed - Avoid older hops - Sanitation



Off flavor	H₂S (Hydrogen sulfide)
Flavor Threshold	4 µg/L
Tastes Like	rotten eggs, sewer
Cause(s)	<ul style="list-style-type: none"> - Produced (and usually cleaned up) by Yeast - Nitrogen Deficiency - Low Yeast Pitch Rates - Excess SO₂ (e.g. from Metabisulfites)
How to Fix	<ul style="list-style-type: none"> - Time. O₂, and/or some trace metals like Copper, in finished beer will react with and decrease H₂S - Stir with Copper (last resort)
How to Avoid	<ul style="list-style-type: none"> - Avoid Underpitching - Add Yeast Nutrients (nitrogen) - Avoid excessive Metabisulfite additions



Off flavor	Mercaptan (Ethanethiol)
Flavor Threshold	4.5 µg/L
Tastes Like	sewer, drains, garbage
Cause(s)	<ul style="list-style-type: none">- Yeast Autolysis- Dry Hopping
How to Fix	n/a
How to Avoid	<ul style="list-style-type: none">- Pitch Healthy Yeast- Limit beer contact time with Trub (inactive yeast)- Limit Dry Hop Quantities and Contact Time

