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## Flavor Components in Beer

Descriptor	Category	Chemical Name	Styles Acceptable	Causes
Goat hair, candle wax, soapy	Acid	Octanoic acid (Caprylic)	Long-matured lagers	Process and Ingredients: Yeast ( <i>Saccharomyces cerevisiae</i> ), wild yeast ( <i>Brettanomyces</i> ). Released into beer from autolysis during maturation.
Stale cheese, sweaty socks, locker room	Acid	3-Methylbutanoic acid (Isovaleric acid)	IPA	Process and Ingredients: Isomerized hop alpha acids, wild yeast
Vinegar, spoiled beer	Acid	Acetic acid (Vinegar)	American Brett, American Sour, Belgian-Style Lambic/Gueuze and Flanders	Bacteria: <i>Acetobacter</i> (aerobic bacteria)
Vomit	Acid	Butyric acid	N/A	Bacteria: <i>Clostridium butyricum</i>
Yogurt, sauerkraut, sour milk	Acid	Lactobacillus (Lactic acid)	Belgian-Style Wit, Saison, Lambic, Flanders, American Sour, Barrel-Aged Beer	Bacteria: Can be added intentionally or the result of contamination.
Granny Smith apples, Jolly Rancher, latex paint, black olives, fresh-cut pumpkin	Carbonyl compound	Acetaldehyde (Green beer)	American lagers, French-Style Biere de Garde	Process and Ingredients: Yeast ( <i>Saccharomyces cerevisiae</i> ), bacteria ( <i>Zymomonas</i> ), high fermentation temperatures, over-pitching, under-aeration
Banana, pear drops	Ester	Isoamyl Acetate	German-style wheat beers	Ingredients: Yeast ( <i>Saccharomyces cerevisiae</i> , <i>Saccharomyces pastorianus</i> ). Disappears with age.
Pear drops (smaller concentration), nail polish remover (higher concentration)	Ester	Ethyl Acetate	Ales especially strong ales	Ingredients: Yeast ( <i>Saccharomyces cerevisiae</i> ) or wild yeast. Stems from acetic acid.
Red apple, anise seed, fennel	Ester	Ethyl Hexanoate	Varies	Process and Ingredients: Yeast ( <i>Saccharomyces cerevisiae</i> ). Caused by poor handling, produced by yeast during fermentation.
Tinned pineapple, mango, papaya	Ester	Ethyl Butyrate	N/A	Ingredients: Hops, yeast
Blackcurrant juice, tomato urine	Flavor Component	p-menthane-8-thiol-3-one (Catty)	Some highly aromatic hopped beers	Ingredients: Hops (Simcoe® hops are one example that displays these characteristics)
Antiseptic, mouthwash, chlorine	Phenol	2,6-Dichlorophenol (Chlorophenol)	N/A	Contamination of brewing or water or packaging or contact with chlorinated water. Reaction of chlorine-based sanitizer (bleach) with phenol compounds.
Barn, mice	Phenol	4-Ethylphenol	Wild beers	Ingredients: Wild yeast ( <i>Brettanomyces</i> )
Clove, nutmeg, allspice	Phenol	4-Vinyl guaiacol (Phenolic, also called 4-VG)	German-Style Wheat beers	Ingredients: Low levels from wort production, high levels from yeast or wild yeast contamination.
Electrical short, inky	Phenol	Bromophenols	N/A	Packaging materials
Felt and sandpaper sensations in mouthfeel. High levels of astringency.	Phenol	Polyphenols/Tannins (Astringent)	Barrel-Aged beers, spiced or highly hopped beers	Process and Ingredients: Comes from wood aging, malt husks and hops. Oxidation of phenols can contribute to darker beer color.
Smoky, meat	Phenol	4-Ethylguaiacol	American Brett beers	Ingredients: Wild yeast ( <i>Brettanomyces</i> ). Described as smokey and produces the characteristic Brett flavor.
Salt	Sodium	Sodium chloride (Table salt), Magnesium sulfate (Epsom), Calcium sulfate (Gypsum)	Varies	Magnesium sulfate (Epsom) breaks down into Magnesium chloride, increasing bitter, Calcium sulfate (Gypsum) causes beer to be very dry.

Descriptor	Category	Chemical Name	Styles Acceptable	Causes
Boiled or rotten eggs, Burton snatch, burnt match	Sulfur	Hydrogen sulfide (Sulfitic)	Varies. Some German-style lagers and English-style ales (Burton Snatch)	Process and Ingredients: Yeast ( <i>Saccharomyces cerevisiae</i> , <i>Saccharomyces pastorianus</i> ), bacteria. Results from metabolism of the amino acids methionine and cysteine during fermentation and maturation. Scrubbed by CO <sub>2</sub> , so volatilizes off quickly.
Cooked corn, tomato sauce, celery, parsnip, shellfish, oysters	Sulfur	Dimethyl Sulphide (DMS)	Some pale lagers	Process and Ingredients: Malt germination, bacteria. Volatilizes off during boil. More common to 6-row barley and paler malts. Vigorous, quick cooling and/or CO <sub>2</sub> scrubbing during fermentation helps to minimize.
Drains, rotting garbage, rotting vegetables	Sulfur	Methanethiol (Mercaptan)	N/A	Process and Ingredients: Yeast, bacteria, dry hopping. From yeast: caused by autolysis at end of fermentation or during maturation.
Skunk, freshly-brewed coffee	Sulfur	3-methyl-2-butene-1-thiol	N/A	Packaging and Storage: Photochemical reaction of isomerized hop alpha acids with fluorescent or sunlight. Specifically: photolysis of the alpha acid side chain.
Berries	Taint	B-Damascenone	N/A	Breakdown of precursors from hops; increases during aging.
Corked wine, damp cellar, indoor pool	Taint	2, 4, 6-Trichloroanisole (TCA)	N/A	Packaging and Storage: Recycled wood/cardboard. Can migrate across packaging materials to contaminate raw materials, filter aids and beer. Beers that have cork closures are susceptible. A chemical compound that is a chlorinated derivative of anisole.
Fecal	Taint	Enterobacter	N/A	Bacteria
Germinating malt	Taint	Isobutyraldehyde (Grainy)	Common in low or near-beer	Process and Ingredients: Pale malt, brewhouse procedures
Ink, blood-like	Taint	Ferrous sulphate (Metallic)	N/A	Process and Ingredients: Brewing materials, corrosion. Can be caused by liquid oxidation.
Jasmine and fecal combined, pigs on farm	Taint	Indole	N/A	Bacteria: Coliform
Leather, dry hay	Taint	Isobutylquinoline (Leathery)	N/A	Packaging and Storage: Forms from precursors present prior to storage.
Paper, wet cardboard	Taint	E-2-Nonenal (Oxidized)	English-style Old Ale, some barrel-aged beers	Packaging and Storing: Oxidation. Formed in malt and wort production, where it binds to malt proteins. Released during storage.
Salami, old meat, burnt rubber, sulfur, rancid, reduced head retention and increased carbonation	Taint	Autolysis	Some bottle-conditioned beer (at low levels)	Process and Ingredients, or Packaging and Storing: Stressed yeast or over-aged beer that contained yeast sediment.
Sugar beets, damp soil	Taint	Geosmin	N/A	Contaminated brewing liquor
Vanilla ice cream, custard	Taint	<i>Vanillin</i>	Wood and barrel-aged beers	Process and Ingredients, Packaging and Storage: Aging, wild yeast, storage. Comes from aging on wood, addition of flavor essence, wild yeast contamination or breakdown of phenolic compounds during storage. Charring of oak barrels breaks down lignins into phenolic aldehyde (vanillin)
Butter, buttered popcorn	Vicinal Diketone	2,3-Butanedione (Diacetyl)	Ales, stouts, Bohemian pilsener	Ingredients: Yeast ( <i>Saccharomyces cerevisiae</i> ), bacteria ( <i>Pediococcus</i> ). Leaks out of yeast cells during fermentation, but yeast scavenge and remove later in fermentation. Ensures proper fermentation time. Some lagers go through a "diacetyl rest" at 65 F for two days.
Honey, butter, caramel	Vicinal Diketone	2, 3 Pentanedione (Honey)	N/A	Packaging and Storing: Oxidation. Hard to detect because of high flavor threshold.

Some of this information was sourced from Aroxa, Siebel Institute and FlavorActiv.

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