beer

flavour standard

acetaldehyde

Acetal-dehyde

"like emulsion paint or green apples"

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

5 mg/l

ORIGINS

Produced by yeast during fermentation. Indicative of fermentation problems and poor control of dissolved oxygen in packaging.

CONFUSIONS

- Ethyl hexanoate
- 2,4,6-Trichloroanisole
- *cis*-3-Hexenol

IMPORTANCE

Present in all beers. Characteristic flavour of some beer styles, *eg* Bière de Garde. Off-flavour at high concentrations.

REMARKS

The flavour impact of acetaldehyde is influenced by the sulphur dioxide concentration in the beer.

CAS NUMBER

75-07-0

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beer

flavour standard

2-acetyl pyridine

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

60 µg/l

ORIGINS

One of many compounds formed during malt kilning. Such flavours become more prominent in beers which have been contaminated with caustic cleaning agents.

CONFUSIONS

- Sodium bicarbonate
- Isobutyraldehyde
- Benzaldehyde

IMPORTANCE

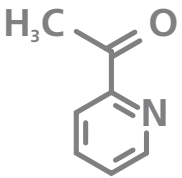
Present in all beers made with barley malt. Desirable flavour in many lagers, ales and stouts. Characteristic flavour of many lagers and ales.

REMARKS

2-Acetyl pyridine is one of many similar compounds which are responsible for the range of malty characters found in beer.

CAS NUMBER

1122-62-9



Malty-biscuity

"like pale barley malt or malt dust"

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beer
flavour standard

benzaldehyde

Almond

"like bitter almonds or marzipan"

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

1 mg/l

ORIGINS

Produced during wort production and modified by yeast during fermentation. Released during beer ageing. Can also be imparted to beer by speciality raw materials, *eg* cherries.

CONFUSIONS

- *cis*-3-Hexenol
- Ethyl hexanoate
- 4-Vinyl guaiacol

IMPORTANCE

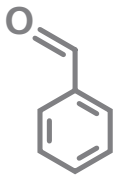
Desirable flavour note in some ales and stouts. Off-flavour in other ales and lagers formed during beer storage. Signature flavour character of cherry-flavoured beers, such as Kriek and Cherry Stout.

REMARKS

The flavour impact of benzaldehyde is influence by the sulphur dioxide concentration of the beer.

CAS NUMBER

100-52-7



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flavour standard

2-bromophenol

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

100 ng / l

ORIGINS

External contamination of packaging materials. Especially associated with use of recycled wood and cardboard. Fireproofing materials also present a risk.

CONFUSIONS

- 2,3-Dichlorophenol
- 4-Vinyl guaiacol
- 2,4,6-Tribromoanisole

IMPORTANCE

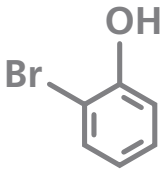
Taint in beer. Associated with a high degree of consumer rejection, even at low levels. Often described by consumers as 'chemical', or 'contaminated'.

REMARKS

Bromophenolic taints can be caused by several compounds, of which 2-bromophenol is only one. The flavour produced by this compound is typical of the group.

CAS NUMBER

95-56-7



Bromo-phenol

"inky, like a museum or old TV set"

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KT22 7RY, UK

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beer

flavour standard

butyric acid

Butyric

"rancid, like baby vomit"

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

3 mg/l

ORIGINS

Produced by bacteria during mashing and sweet wort separation, or during sugar syrup production or storage. Occasionally formed as a result of bacterial spoilage of packaged beer.

CONFUSIONS

- Isovaleric acid
- Ethyl butyrate
- 2,3-Butanedione

IMPORTANCE

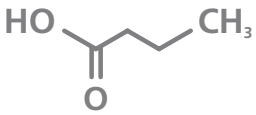
Off-flavour in beer. The flavour of affected beers can be worsened by the presence of 2,3-butanedione, or improved by ethyl butyrate derived from metabolism of butyric acid by yeast.

REMARKS

The intensity of this flavour increases with decreasing beer pH value.

CAS NUMBER

107-92-6



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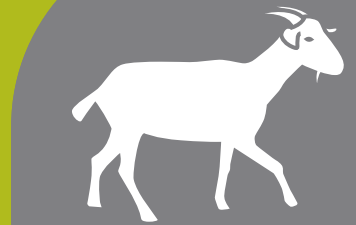
beer
flavour standard
octanoic acid



Caprylic

"like goat hair or candle wax"

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

5 mg/l

ORIGINS

Produced by yeast during maturation of beer. Released into beer from autolysing yeast cells.

CONFUSIONS

- Iso-α-acids
- *trans,trans*-2-4-Heptadienal
- Acetic acid

IMPORTANCE

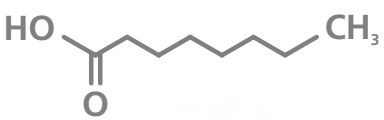
A desirable flavour note of some pale lager beers. Positively affects both flavour and mouthfeel. Associated with traditionally-produced lagers which undergo prolonged maturation.

REMARKS

The form in which this standard is presented allows for use of a lower concentration to generate the required flavour intensity than predicted from its threshold.

CAS NUMBER

124-07-2



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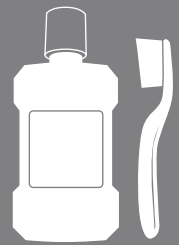
beer

flavour standard

2,6-dichlorophenol



Chloro-phenol

"like antiseptic mouthwash"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

300 ng/l

ORIGINS

External contamination of brewing or dilution liquor and / or packaging materials. Can also be formed by admixture of incompatible cleaning agents or by contact of beer with chlorinated water.

CONFUSIONS

- 2-Bromophenol
- Guaiacol
- 4-Vinyl guaiacol

IMPORTANCE

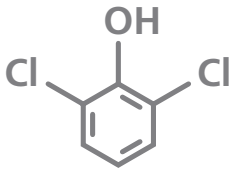
Taint in beer. Associated with a high degree of consumer rejection, even at low levels. Often described by consumers as 'chemical', 'antiseptic' or 'contaminated'.

REMARKS

Chlorophenolic taints can be caused by several compounds of which 2,6-dichlorophenol is only one. The flavour produced by this compound is typical of the group.

CAS NUMBER

87-65-0



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beer

flavour standard

citric acid

ASSESSMENT

Take a little beer into your mouth. Move it around with your tongue for a few seconds then swallow it.

THRESHOLD

60 mg / l

ORIGINS

Acidity in beer is primarily derived from yeast metabolism during fermentation. Acidification in the brewhouse, using bacteria or food-grade acids, is also important.

CONFUSIONS

- Acetic acid
- Lactic acid
- Astringent

IMPORTANCE

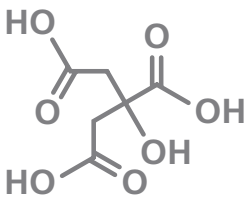
One of five basic tastes found in beer and a major differentiator of styles and products. Signature flavour character of Belgian Sour Ale and Lambic beer.

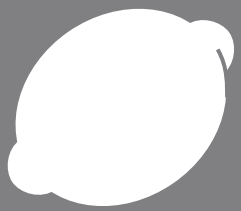
REMARKS

Acidity in beer is caused by a variety of acids including pyruvic acid, α-ketoglutaric acid and free hydrogen ions.

CAS NUMBER

77-92-9





Sour

"like lemon juice or acidic beer"

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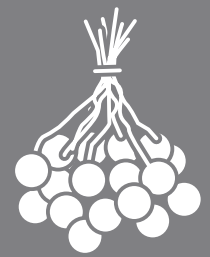
beer
flavour standard
β-damascenone



Damasc-enone

"berries, like a stale highly-hopped beer

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

25 µg/l

ORIGINS

Formed in beer from breakdown of precursors derived from hops. Amount formed is proportional to amount of (green) hop material added to the wort.

CONFUSIONS

- Not yet known

IMPORTANCE

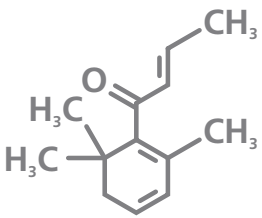
Component of fresh hop aroma in beer. The intensity of this flavour note increases during ageing of beer in pack, particularly in the case of beers which have been highly hopped.

REMARKS

This is a very difficult flavour note for tasters to attach an association to. Flavour terms used by tasters for this compound span a broad range and tend to be used inconsistently.

CAS NUMBER

23696-85-7



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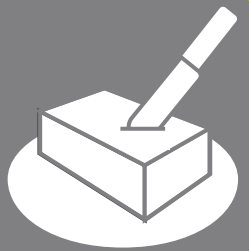
beer

flavour standard

2,3-butanedione



Diacetyl

"like butter, or butter popcorn"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

10 – 40 µg/l

ORIGINS

Produced in beer from a precursor formed by yeast during fermentation. Can also be formed by contaminant lactic acid bacteria.

CONFUSIONS

- Butyric acid
- Vanillin
- Isobutyraldehyde

IMPORTANCE

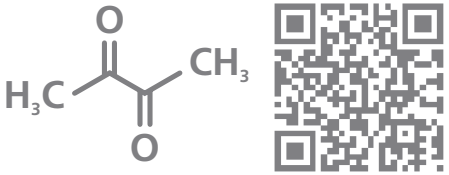
Desirable flavour in some ales, stouts and lagers, *eg* Pilsner. Off-flavour in other lager beers. Considerable efforts are made by breweries to tightly control this flavour character.

REMARKS

2,3-Butanedione is one of two vicinal diketones found in beer. The ratio of diacetyl to pentanedione concentrations can be used as an indicator of bacterial contamination in beer.

CAS NUMBER

431-03-8



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beer

flavour standard

dimethyl disulphide

Rotten vegetable

"like a sewage treatment plant"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

75 µg/l

ORIGINS

Formed in beer as a result of formation of hydrogen sulphide by yeast. If venting of the fermenter is poor (or the fermentation is done under pressure) flavours like this can build up.

CONFUSIONS

- Dimethyl trisulphide
- Methional
- Hydrogen sulphide

IMPORTANCE

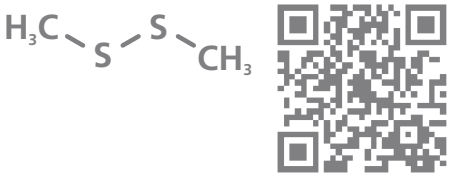
Off-flavour in fresh beer. Also develops in some beers during ageing in pack. Can arise as a taint through use of contaminated carbon dioxide. Some describe this flavour as 'dirty sulphur'.

REMARKS

Some systems for recovery of alcohol from yeast produce distillates containing this flavour. These distillates impart this flavour to the beers to which they are added.

CAS NUMBER

624-92-0



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beer

flavour standard

dimethyl sulphide

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

30 - 50 µg/l

ORIGINS

Formed from malt-derived precursors, primarily during wort production and – to a lesser extent – during fermentation.

CONFUSIONS

- Methyl thioacetate
- Ethanethiol
- Dimethyl trisulphide

IMPORTANCE

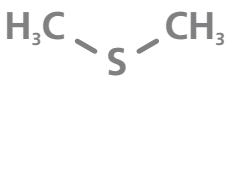
Desirable flavour in some pale lager beers and ales. Off-flavour in other beers. Excessive levels are indicative of growth of contaminant bacteria during fermentation.

REMARKS

The perception of dimethyl sulphide is influenced by the presence of aromatic higher alcohols such as 2-phenylethanol in beer.

CAS NUMBER

75-18-3



DMS

"like sweetcorn or tomato sauce"

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beer

flavour standard

dimethyl trisulphide

Onion

"like fried onion or garlic"

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

40 ng/l

ORIGINS

Although produced from amino acids during wort boiling most dimethyl trisulphide is formed during storage of packaged beer. Some hops impart this character when used post-fermentation.

CONFUSIONS

- Methanethiol
- Ethanethiol
- Dimethyl sulphide

IMPORTANCE

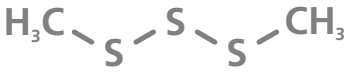
Desirable hop-derived flavour note in some ales. Off-flavour formed during ageing of pale lager beers. Can also be found in fresh lager beer as a result of wort boiling practices.

REMARKS

Recognized as an important contributor to the aged character of pale lager beers.

CAS NUMBER

3658-80-8



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beer

flavour standard

ferrous sulphate

Metallic

"like ink or blood"

ASSESSMENT

Take a little beer into your mouth. Move it around with your tongue for a few seconds then swallow it. To confirm, rub a little of the beer onto the back of your hand and check for metallic odour.

THRESHOLD

2.7 mg/l

ORIGINS

Derived from contamination of beer with metal ions, either from brewing raw materials or from corrosion of brewery plant.

CONFUSIONS

- Sulphitic
- Citric acid
- *trans*-2-Nonenal

IMPORTANCE

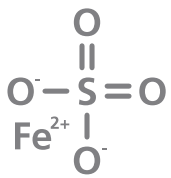
Taint and occasionally off-flavour in beer. Primarily affects beer mouthfeel but occasionally beer odour can also be affected. Metallic odours can also be produced by lipid oxidation.

REMARKS

Copper, manganese and tin can also generate metallic notes in beer. Such metals stabilize beer foam and shorten beer flavour life.

CAS NUMBER

7782-63-0



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beer
flavour standard

acetic acid

Acetic

"like vinegar or spoiled beer"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

90 mg/l

ORIGINS

Produced by yeast during fermentation. Too much yeast growth, contaminating bacteria and wild yeasts can produce excessive levels.

CONFUSIONS

- Citric acid
- Lactic acid
- Acetaldehyde

IMPORTANCE

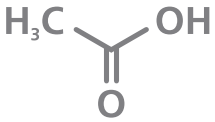
Present in all beers. Characteristic flavour of some beer styles, *eg* Lambic beer. Off-flavour at high concentrations. Common problem in draught-dispensed beers.

REMARKS

The intensity of this flavour increases with decreasing beer pH value.

CAS NUMBER

64-19-7



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beer
flavour standard
ethyl acetate

Ethyl acetate

"like nail varnish remover"

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

10 mg/l

ORIGINS

Produced by both ale and lager yeast during fermentation. Amount depends on wort composition, yeast strain and fermentation conditions. Wild yeasts produce high levels.

CONFUSIONS

- Acetaldehyde
- Ethyl hexanoate
- Ethyl butyrate

IMPORTANCE

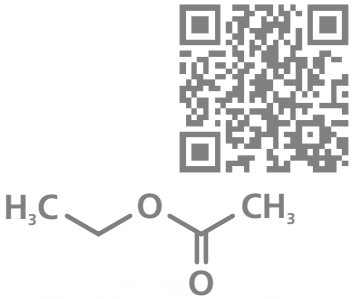
Present in all beers, and the ester found in greatest amounts. Its high flavour threshold means that it makes a bigger contribution to the flavour of ales - and especially strong ales - than it does to lagers.

REMARKS

Use two capsules of this flavour standard in each litre of beer to achieve a similar flavour intensity to that achieved using other flavour standards.

CAS NUMBER

141-78-6



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beer

flavour standard

ethyl butyrate

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

300 µg/l

ORIGINS

Produced by both ale and lager yeast during fermentation. Amount depends on wort composition, yeast strain and fermentation conditions. Can be indicative of brewhouse hygiene problems.

CONFUSIONS

- Butyric acid
- Acetaldehyde
- Isoamyl acetate

IMPORTANCE

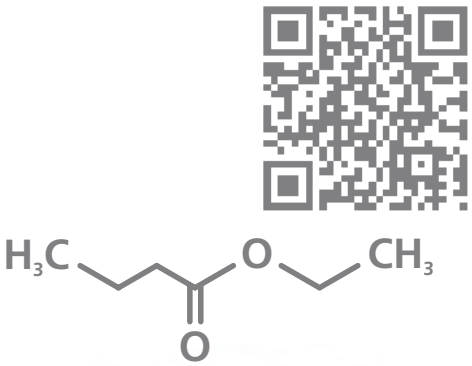
Contributes a pleasant 'tropical fruit ester' note to ales and lagers. Associated with use of particular yeast strains and hop varieties.

REMARKS

Ethyl butyrate is one of a several such esters found in beer. Others include isoamyl butyrate, ethyl isobutyrate, and isoamyl isobutyrate.

CAS NUMBER

105-54-4



Ethyl butyrate

"like tinned pineapple or mango"

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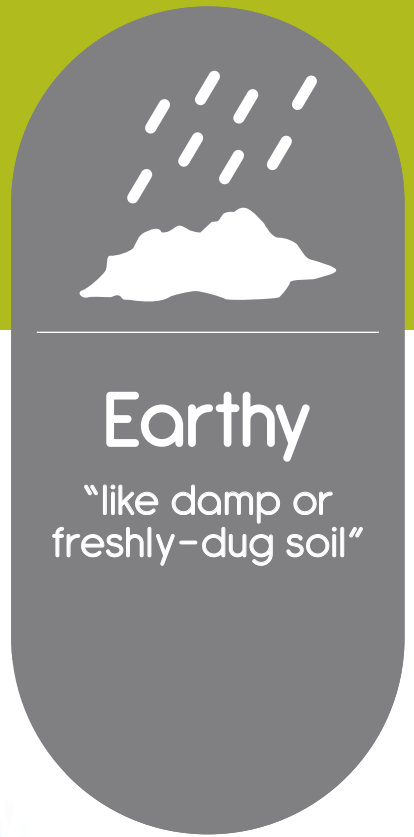
beer

flavour standard

ethyl fenchol



ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

30 µg/l

ORIGINS

Imparted through use of contaminated brewing liquor, rinse liquor or dilution liquor.
The flavour arises from growth of microorganisms in the water supply.

CONFUSIONS

- Geosmin
- 2-Methylisoborneol
- 2-Isopropyl-3-methoxypyrazine

IMPORTANCE

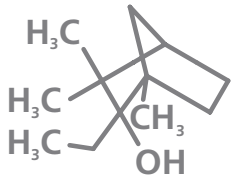
Taint in beer. Associated with a moderate degree of consumer rejection. Often described by consumers as 'dirty' or 'contaminated'.

REMARKS

This is a problem usually associated with abstraction of surface waters. Water treatment practices should remove any ethyl fenchol present prior to use.

CAS NUMBER

18368-91-7



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beer

flavour standard

ethyl hexanoate

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

200 µg/l

ORIGINS

Produced by both ale and lager yeast during fermentation. Amount produced depends on wort composition, yeast strain and fermentation conditions.

CONFUSIONS

- Acetaldehyde
- Ethyl butyrate
- Geraniol

IMPORTANCE

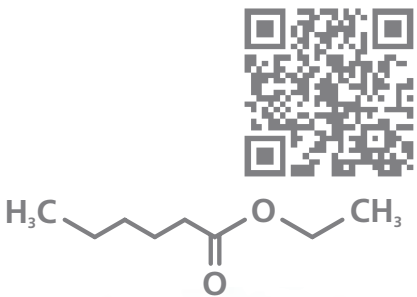
Present in all beers. Concentrations vary from beer to beer. Key flavour impact character in some lagers and ales.

REMARKS

Excessive concentrations of ethyl hexanoate are indicative of poor yeast handling in the brewery.

CAS NUMBER

123-66-0



Ethyl hexan-oate

"like apple or aniseed"

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beer

flavour standard

ethyl phenylacetate

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

160 µg/l

ORIGINS

Formed during ageing of beer. Tends to develop after the appearance of papery, tobacco and leathery notes, and after the loss of banana and bitter notes.

CONFUSIONS

- Not yet known

IMPORTANCE

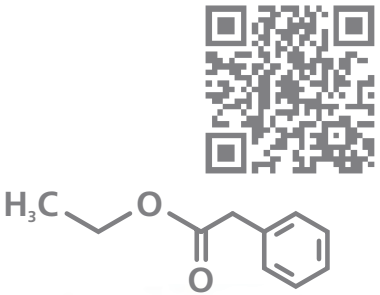
Off-flavour formed during ageing in pack from precursors which are formed during fermentation. Positive flavour note in Honey beers.

REMARKS

This compound is also responsible for the sweet, honey-like off-flavours which develop in some white wines. This flavour note is slow to develop on the palate.

CAS NUMBER

101-97-3



Honey

"like sweet mead or sherry"

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beer
flavour standard

eugenol

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

130 µg/l

ORIGINS

Formed during ageing of beer from precursors which are formed by yeast during fermentation. Associated with use of warm fermentation temperatures.

CONFUSIONS

- Vanillin
- 4-Vinyl guaiacol
- Benzaldehyde

IMPORTANCE

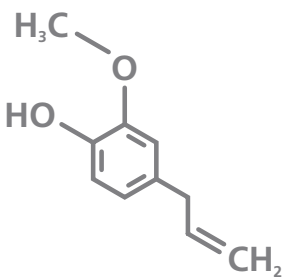
Flavour impact character in some beer styles, *eg* Belgian ales. Off-flavour in lager beers. More common in beers of higher alcohol content (> 7% vol / vol).

REMARKS

Often present together with other phenolic and spicy flavour compounds to generate complex aromatic notes.

CAS NUMBER

97-53-0



Spicy

"like clove oil or allspice"

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beer
flavour standard

geosmin

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

20 ng/l

ORIGINS

Imparted through use of contaminated brewing liquor, rinse liquor or dilution liquor. Source of the taint is growth of microorganisms in the water supply.

CONFUSIONS

- 2-Methylisoborneol
- Ethyl fenchol
- 2-Isopropyl-3-methoxypyrazine

IMPORTANCE

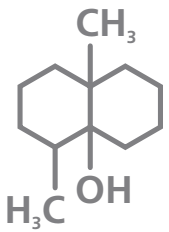
Taint in beer. Associated with a moderate degree of consumer rejection. Often described by consumers as ‘dirty’ or ‘contaminated’.

REMARKS

This is a problem usually associated with abstraction of surface waters. Water treatment practices should remove any geosmin present prior to use.

CAS NUMBER

23333-91-7



Geosmin

“like sugar beets or damp soil”

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beer
flavour standard

geraniol

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

20 - 400 µg/l

ORIGINS

Contributed to beer *via* hops added in the kettle, during fermentation, or after fermentation. Concentrations in beer depend on the hop variety, hopping regimen and process conditions.

CONFUSIONS

- Kettle hop extract
- *cis*-3-Hexenol
- Hop oil extract

IMPORTANCE

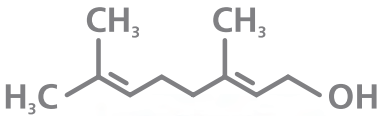
Positive flavour character of hoppy beers. Partly responsible for the floral, rose-like note imparted by some hop varieties and hopping practices.

REMARKS

One of many terpene-related compounds found in hops which impart distinctive flavour notes to beer. Others include myrcene and linalool.

CAS NUMBER

106-24-1



Geraniol

"like rose petals or floral hops"

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beer

flavour standard

guaiacol

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

33 µg/l

ORIGINS

Contributed to brewing raw materials (malt, rice *etc*) by intentional or non-intentional exposure to smoke. Occasionally formed by bacteria during fermentation.

CONFUSIONS

- 4-Vinyl guaiacol
- Eugenol
- 2,6-Dichlorophenol

IMPORTANCE

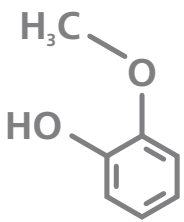
Off-flavour in pale lager beers. A desirable character in some ales in which it is imparted by speciality malts. Signature flavour character of Rauchbier (smoked beer).

REMARKS

A flavour which tends to polarize consumers – they either love it or hate it.

CAS NUMBER

90-05-1



Smoky

"like smoked fish or cheese"

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beer

flavour standard

trans,trans-2,4-heptadienal

Rancid oil

"like cod liver oil"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

150 µg/l

ORIGINS

Formed in adjuncts, such as maize, during storage as a result of enzymic or non-enzymic lipid oxidation. Use of such materials can lead to development of this rancid oil flavour note in beer.

CONFUSIONS

- Not yet known

IMPORTANCE

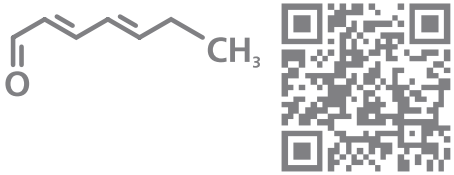
Off-flavour in beer associated with ageing. Beers made with oil-rich adjuncts are most susceptible to development of this flavour.

REMARKS

Common fault in high adjunct pale lager beers made in warm climates. Develops during the early stages of oxidation, before the appearance of papery and leathery notes.

CAS NUMBER

4313-03-5



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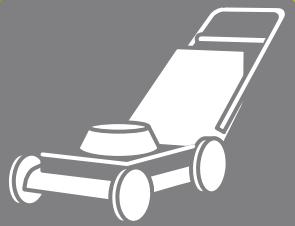
flavour standard

cis-3-hexenol



Freshly cut grass

"like hedge cuttings"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

1.1 mg/l

ORIGINS

Several compounds, closely related to *cis*-3-hexanol also impart grassy notes to beer. Although they are mostly hop-derived they can also arise through use of immature malts, such as chit malt.

CONFUSIONS

- Acetaldehyde
- Kettle hop extract
- Isobutyraldehyde

IMPORTANCE

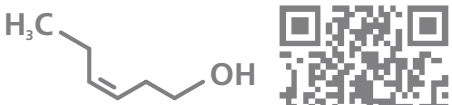
Positive flavour character in some ales and lagers, imparting a fresh 'green' flavour note. Considered an off-flavour when present in excess.

REMARKS

cis-3-Hexenol is one of several compounds that impart an odour of freshly cut grass to beer. Its corresponding aldehyde *cis*-3-hexenal also contributes to this flavour.

CAS NUMBER

928-96-1



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beer
flavour standard
hop oil extract

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

250 µg/l

ORIGINS

Contributed to beer by addition of hop oils in the brewhouse, fermentation or post-fermentation. The intensity and nature of the character depends on the hop products and brewing practices.

CONFUSIONS

- Kettle hop extract
- Geraniol
- 4-Vinyl guaiacol

IMPORTANCE

Positive flavour character imparted to specialty ales by addition of hop oil. Different hop varieties in combination with different beers give rise to a variety of hop flavour characteristics.

REMARKS

Not a reference standard in the strictest sense, since the flavour is derived from a complex natural mixture of many compounds.

CAS NUMBER

8007-04-3

Hop oil

"like hoppy ale"

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beer
flavour standard
indole

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

15 µg/l

ORIGINS

Formed by contaminant 'coliform' bacteria during fermentation. Often associated with simultaneous production of dimethyl sulphide.

CONFUSIONS

- Octanoic acid
- Benzaldehyde
- β-Damascenone

IMPORTANCE

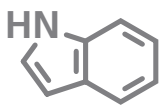
Off-flavour in lagers, ales and stouts. Regarded by some as 'artisanal' character ('jasmine / floral') and by others as a serious off-note ('faecal / dirty').

REMARKS

Big differences in perception of individual tasters and consumers result in about half regarding this flavour as a serious fault and half being oblivious to it.

CAS NUMBER

120-72-9



Indole

"like pigs on a farm"

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beer

flavour standard

iso-α-acids

ASSESSMENT

Take a little beer into your mouth. Move it around with your tongue for a few seconds then swallow it.

THRESHOLD

3 mg/l

ORIGINS

Imparted to beer through addition of hops or hop extracts in the brewhouse or post-fermentation. The intensity and quality of the bitterness depends on the hop variety, hopping practice, and brewing process.

CONFUSIONS

- Ferrous sulphate
- Sodium bicarbonate
- Octanoic acid

IMPORTANCE

One of the five basic tastes found in beer and a major differentiator of styles and products. Important flavour note in lagers, ales and stouts. Signature flavour note in India Pale Ales.

REMARKS

This flavour standard is rich in *cis* isomers of the iso-α-acids, which are more bitter than their *trans* counterparts. This allows us to employ a smaller amount of material than might be expected to produce the desired flavour impact.

CAS NUMBER

247-072-1

Bitter

"like beer"

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beer
flavour standard
isoamyl acetate

ASSESSMENT
Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD
1.1 mg/l

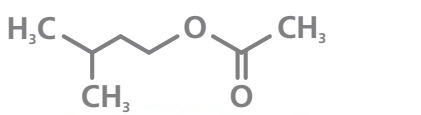
ORIGINS
Produced by both ale and lager yeast during fermentation. Amount depends on wort composition, yeast strain and fermentation conditions.

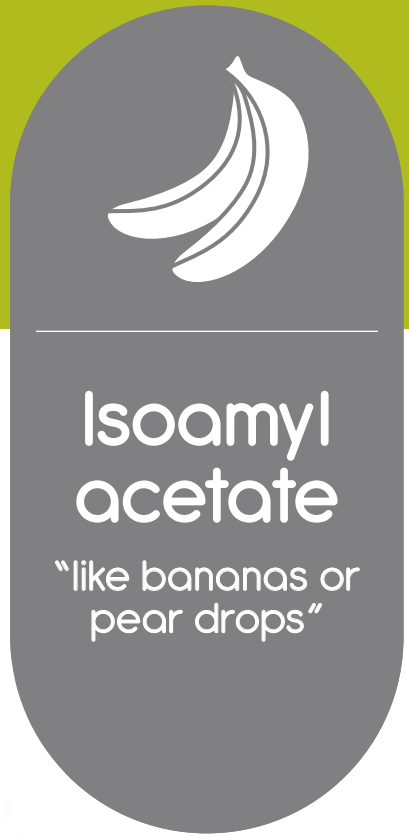
CONFUSIONS
- Ethyl hexanoate
- Ethyl acetate
- Ethyl butyrate

IMPORTANCE
Present in all beers. Concentrations vary considerably from beer to beer. Key flavour impact character in some lagers and ales. Signature flavour character in German-style wheat beer.

REMARKS
Disappears during ageing of beer in pack, contributing to a loss of freshness.

CAS NUMBER
123-92-2





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flavour standard

isobutylquinoline

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

20 µg/l

ORIGINS

The precise origins of isobutylquinoline in beer are not known, save for that it is formed during storage of packaged beer from precursors present prior to storage.

CONFUSIONS

- *trans*-2-Nonenal
- 2-Ethyl fenchol
- Isobutyraldehyde

IMPORTANCE

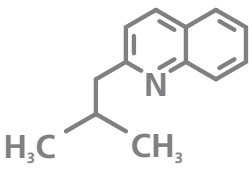
Off-flavour associated with the intermediate stages of beer ageing. Develops later in the ageing process, after the appearance of rancid oil and papery notes.

REMARKS

Acts synergistically with papery notes, such as those imparted by *trans*-2-nonenal, to impart a stale character to beer.

CAS NUMBER

1333-58-0



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beer

flavour standard

2-isobutyl-3-methoxypyrazine

Earthy

"like green pepper"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

20 ng/l

ORIGINS

Imparted through use of contaminated brewing liquor, rinse liquor or dilution liquor. Source of the taint is growth of microorganisms in the water supply.

CONFUSIONS

- Not yet known

IMPORTANCE

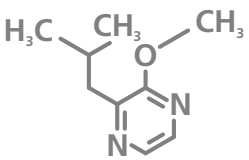
Taint in beer. Associated with a high degree of consumer rejection. Often described by consumers as 'chemical' or 'contaminated'.

REMARKS

Methoxypyrazine taints can be caused by several compounds, of which 2-isobutyl-3-methoxypyrazine is only one. Water treatment practices should remove the methoxypyrazine prior to use.

CAS NUMBER

24683-00-9



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beer

flavour standard

isobutyraldehyde

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

10 - 25 µg/l

ORIGINS

Isobutyraldehyde and related compounds can arise in beer through use of pale malts and certain brewhouse procedures. Yeast strain and vigour is also important.

CONFUSIONS

- Acetaldehyde
- *trans*-2-Nonenal
- *trans,trans*-2,4-Heptadienal

IMPORTANCE

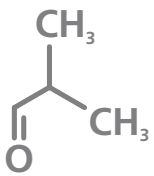
Present in all beers. Concentrations vary from beer to beer. Key flavour impact character in some lagers and ales. Off-flavour in low and non-alcoholic beers. Signature flavour character in some stouts.

REMARKS

Several compounds, closely related to isobutyraldehyde also impart grainy notes to beer. The flavour impact of such aldehydes is influenced by the sulphur dioxide concentration of the beer.

CAS NUMBER

78-84-2



Grainy

"like germinating malt"

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beer

flavour standard

2-isopropyl-3-methoxypyrazine

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

2 ng/l

ORIGINS

Imparted through use of contaminated brewing liquor, rinse liquor or dilution liquor. Source of the taint is growth of microorganisms in the water supply.

CONFUSIONS

- Not yet known

IMPORTANCE

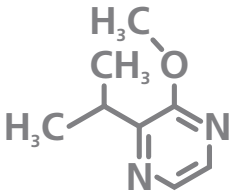
Taint in beer. Associated with a moderate degree of consumer rejection. Often described by consumers as ‘dirty’ or ‘contaminated’.

REMARKS

Methoxypyrazine taints can be caused by several compounds, of which 2-isopropyl-3-methoxypyrazine is only one. Water treatment practices should remove the methoxypyrazine prior to use.

CAS NUMBER

25773-40-4



Earthy

“like potato skins or dug soil”

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beer

flavour standard

isovaleric acid

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

1 mg/l

ORIGINS

Derived from breakdown of alpha-acids in hops. Imparted to beer by use of high hopping rates or degraded hops or hop extracts. Can occasionally be produced by wild yeasts.

CONFUSIONS

- Butyric acid
- Ethyl butyrate
- 2,3-Butanedione

IMPORTANCE

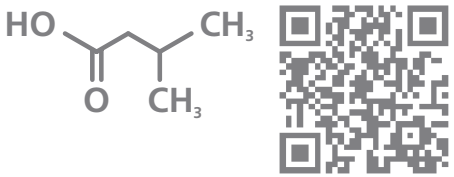
Characteristic flavour of some beer styles, *eg* India Pale Ale. Typical 'cheesy' character associated with beers of very high bitterness. Off-flavour at high concentrations.

REMARKS

The intensity of this flavour increases with decreasing beer pH value.

CAS NUMBER

503-74-2



Isovaleric

"like stale cheese or sweaty socks"

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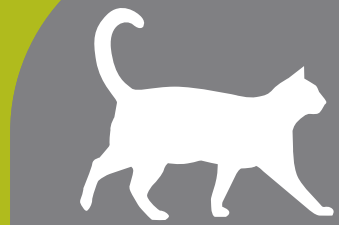
beer

flavour standard

p-menthane-8-thiol-3-one



Catty

"like blackcurrant juice or tom cat urine"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

60 ng/l

ORIGINS

As a taint, catty flavour arises due to contamination of malt with mesityl oxide. As an off-flavour, it is formed during beer ageing in pack. Can also arise through use of specific hop varieties.

CONFUSIONS

- Ethyl butyrate
- Ethanethiol
- Methanethiol

IMPORTANCE

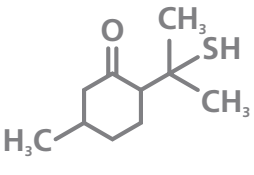
Positive flavour character imparted to beer by the use of specific hop varieties. Can also be a taint or off-flavour. Often described by consumers as 'fruity'.

REMARKS

A range of compounds impart catty characters to beer. The specific compound depends on the source. The compound used in this flavour standard is representative of the flavour of such compounds.

CAS NUMBER

38462-22-5



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beer
flavour standard
methanethiol

Mercaptan

"like drains or rotting garbage"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

1.5 µg/l

ORIGINS

Arises through yeast autolysis at the end of fermentation or during maturation. Can also be contributed by dry hopping and by growth of bacteria in beer.

CONFUSIONS

- Ethanethiol
- Dimethyl trisulphide
- Sulphur dioxide

IMPORTANCE

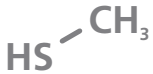
Component of the sulphury flavour character of beer. Found in all beer styles to a degree. Off-flavour when present in excess.

REMARKS

Methanethiol is the main thiol found in beer. Other thiols give similar flavour notes which have subtle differences in relation to their flavour associations.

CAS NUMBER

75-08-01



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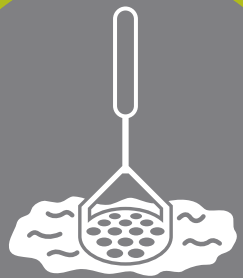
beer
flavour standard
methional



Methional

"like mashed potato or autolysed yeast"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

5 µg/l

ORIGINS

Produced in the brewhouse from breakdown of amino acids. Released during beer ageing. Also associated with re-use of beer recovered from yeast and with over-pasteurization of beer.

CONFUSIONS

- Methanethiol
- Dimethyl disulphide
- Hydrogen sulphide

IMPORTANCE

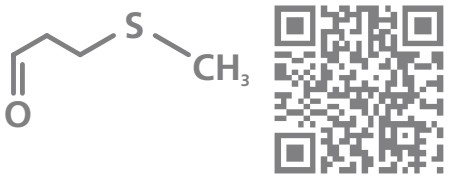
Important ageing character of lager, ales and stouts. Sulphury off-flavour of fresh lager beer. Signature 'worty' note in many low- and non-alcoholic beers.

REMARKS

The flavour impact of methional is influenced by both the alcohol and sulphur dioxide concentrations of the beer. Higher concentrations of both compounds suppress its flavour.

CAS NUMBER

3268-49-3



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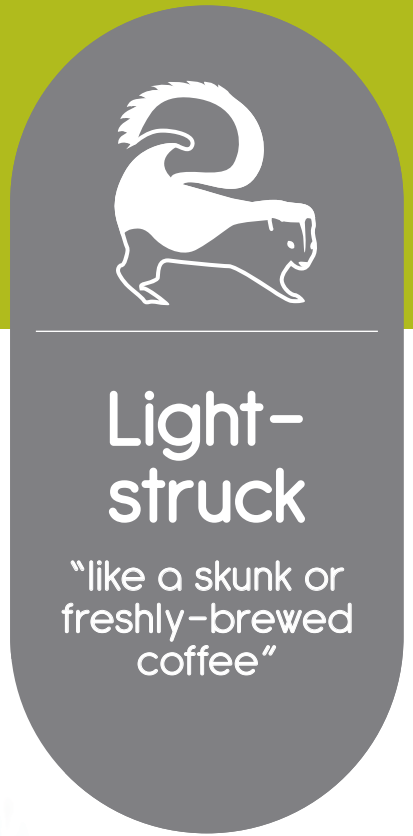
beer

flavour standard

3-methyl-2-butene-1-thiol



Light-struck

"like a skunk or freshly-brewed coffee"

ASSESSMENT

Best detected by smelling the beer at a distance. Hold the glass at arm's length and take short sniffs to prevent the risk of adaptation.

THRESHOLD

4 – 30 ng/l

ORIGINS

Formed as a result of exposure of beer to daylight or artificial light. This initiates a reaction involving hop bitter acids, vitamins and sulphur compounds. Small amounts are also formed in beer production.

CONFUSIONS

- Sulphur dioxide
- *cis*-3-Hexenol
- Ethanethiol

IMPORTANCE

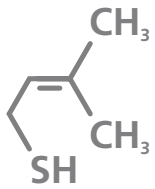
Off-flavour associated with exposure to light of beer packaged in clear or green glass. Consumers are very tolerant of this off-flavour. Many successful beers contain this flavour at the point of consumption.

REMARKS

Beers which have been bittered with chemically-modified hop extracts do not develop this character.

CAS NUMBER

5287-45-6



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beer

flavour standard

2-methylisoborneol

Earthy

"mouldy, like peat or compost"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

85 ng/l

ORIGINS

Imparted through use of contaminated brewing liquor, rinse liquor or dilution liquor. Source of the taint is growth of microorganisms in the water supply.

CONFUSIONS

- Geosmin
- Ethyl fenchol
- 2-Isopropyl-3-methoxypyrazine

IMPORTANCE

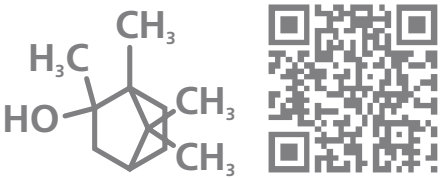
Taint in beer. Associated with a moderate degree of consumer rejection. Often described by consumers as 'dirty' or 'contaminated'.

REMARKS

This is a problem usually associated with abstraction of surface waters. Water treatment practices should remove the methylisoborneol prior to use.

CAS NUMBER

2371-42-8



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beer

flavour standard

methyl thioacetate

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

85 µg/l

ORIGINS

Produced by lager yeast (but not by ale yeast) during fermentation. Amount produced depends on wort composition, yeast strain and fermentation conditions.

CONFUSIONS

- Dimethyl sulphide
- Dimethyl trisulphide
- Dimethyl disulphide

IMPORTANCE

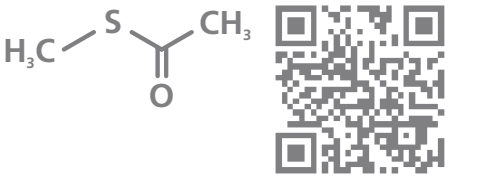
Positive sulphury flavour note in some lagers. Off-flavour in other lagers and in all ales and stouts.

REMARKS

As a sulphur ester, production of methyl thioacetate by yeast closely parallels that of other esters such as ethyl acetate.

CAS NUMBER

1534-08-3



Cooked vegetable

"like boiled cauliflower"

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beer

flavour standard

sodium chloride

Salty

"like table salt"

Na^+Cl^-

ASSESSMENT

Take a little beer into your mouth. Move it around with your tongue for a few seconds then swallow it.

THRESHOLD

200 mg/l

ORIGINS

Contributed to beer by both malt and brewing liquor. Some brewers add sodium chloride in the brewhouse to provide palate smoothness.

CONFUSIONS

- Sodium bicarbonate
- Citric acid
- Iso-α-acids

IMPORTANCE

One of the five basic tastes found in beer and a differentiator of beer styles and products. Important flavour note in lagers, ales and stouts. Chloride ions contribute to overall flavour balance and smoothness.

REMARKS

Salts derived from brewing liquor and brewing raw materials influence beer flavour both directly and indirectly.

CAS NUMBER

7647-14-5

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flavour standard

sodium bicarbonate

Alkaline

"like caustic or detergent"

ASSESSMENT

Take a little beer into your mouth. Move it around with your tongue for a few seconds then swallow it.

THRESHOLD

220 mg/l

ORIGINS

Accidental contamination of beer with caustic cleaning agents. Incidents are associated with an increase in beer colour and sodium ion concentrations.

CONFUSIONS

- 2-Acetyl pyridine
- Iso-α-acids
- *trans,trans*-2-4-Heptadienal

IMPORTANCE

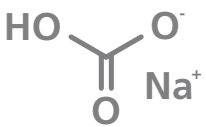
Taint in beer. Increases in beer pH value affect beer flavour indirectly, altering the flavour activity of many acidic and basic flavour compounds, giving rise to 'bready' and 'sweet' flavour notes.

REMARKS

Detection of alkaline flavour notes in beer is essential to protect against the risk of releasing beer to the market which has been contaminated with cleaning agents.

CAS NUMBER

144-55-8



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beer

flavour standard

trans-2-nonenal

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

50 – 250 ng/l

ORIGINS

Formed in malt and wort production where it binds to malt proteins. Carried through the brewing process in this bound form. Released during storage of finished beer in pack.

CONFUSIONS

- 2,4,6-Trichloroanisole
- 2-Ethyl fenchol
- Isobutyraldehyde

IMPORTANCE

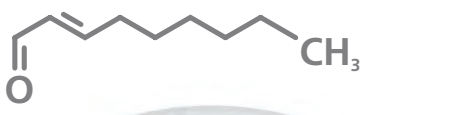
Off-flavour in beer associated with ageing. Formation of this flavour is more pronounced when precautions have not been taken in relation to minimizing process oxidation.

REMARKS

Sulphur dioxide in beer reversibly reacts with *trans*-2-nonenal to reduce its flavour impact.

CAS NUMBER

18829-56-6



Papery

"like cardboard or oxidized beer"

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beer
flavour standard
kettle hop extract

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

80 µg/l

ORIGINS

Kettle hop notes are contributed to beer by addition of hop materials in the brewhouse. The intensity and nature of the character depends on the hop products and brewing practices.

CONFUSIONS

- Geraniol
- Hop oil extract
- Isovaleric acid

IMPORTANCE

Positive flavour character in 'hoppy' lagers. Different hop varieties in combination with different brewing practices give rise to a variety of hop flavour intensities and characteristics.

REMARKS

Not a reference standard in the strictest sense, since the flavour is derived from a complex natural mixture of many compounds.

CAS NUMBER

8007-04-3

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beer

flavour standard

hydrogen sulphide

H_2S

"like boiled or rotten eggs"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

4 µg/l

ORIGINS

Produced by both ale and lager yeast during fermentation and maturation. Amount depends on wort composition, yeast strain and fermentation conditions.

CONFUSIONS

- Sulphur dioxide
- Ethanethiol
- Methanethiol

IMPORTANCE

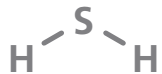
Present in all beers. Concentrations vary considerably from beer to beer. Off-flavour in most beer styles. Signature flavour character in Burton ale.

REMARKS

Can contribute to a perception of 'freshness' in beer when present at low levels.

CAS NUMBER

7783-06-4



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beer

flavour standard

styrene

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

20 µg/l

ORIGINS

Produced by contaminant wild yeasts during fermentation. Can taint product through use of contaminated packaging materials or defective carbon dioxide gas.

CONFUSIONS

- Acetaldehyde
- 4-Vinyl guaiacol
- Eugenol

IMPORTANCE

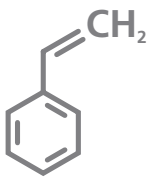
Off-flavour or taint in beer. Associated with a moderate degree of consumer rejection. Often described by consumers as ‘chemical’, ‘plasticy’ or ‘contaminated’.

REMARKS

Other compounds can impart a plastic-like note to beer. Samples containing this standard are best tasted in glass, rather than in plastic, to avoid loss of odour.

CAS NUMBER

100-42-5



Plastics

“like polystyrene”

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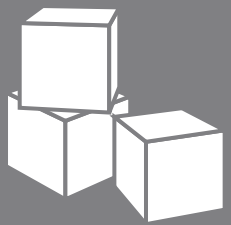
flavour standard

sucralose



Sweet

"like sugar"

ASSESSMENT

Take a little beer into your mouth. Move it around with your tongue for a few seconds then swallow it.

THRESHOLD

2.6 mg/l

ORIGINS

Sweet taste is contributed to beer by sugars, such as glucose, maltose and maltotriose, which most yeasts remove. Less attenuative yeasts leave some behind.

CONFUSIONS

- Not yet known

IMPORTANCE

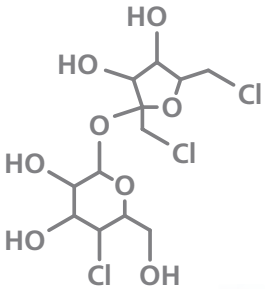
One of the five basic tastes found in beer and a differentiator of beer styles and products. Key flavour character in primed lagers and ales. Signature flavour character in Sweet stout.

REMARKS

Sucralose is used in this flavour standard to mimic the taste of natural beer sugars.

CAS NUMBER

56038-13-2



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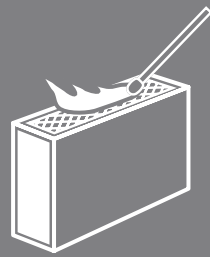
beer

flavour standard

sulphur dioxide



Sulphitic

"like a struck match or young white wine"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

3 – 7 mg/l

ORIGINS

Produced by lager (but not by ale or wheat beer) yeast during fermentation. May be added to beer as an antioxidant in some markets.

CONFUSIONS

- Ethanethiol
- Dimethyl trisulphide
- Hydrogen sulphide

IMPORTANCE

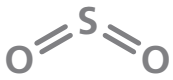
Sulphites keep beer fresh during storage. They affect the flavour intensity of many beer aldehydes. When added as an antioxidant, they impart a distinctive sulphury character to fresh beer.

REMARKS

About 1% of tasters are sensitive to sulphites and may suffer an allergic reaction - check prior to providing samples.

CAS NUMBER

7757-83-7



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beer

flavour standard

2,4,6-tribromoanisole

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

<10 – 500 ng / l

ORIGINS

Associated with use of recycled wood and cardboard. Can migrate across packaging materials to contaminate raw materials, filter aids, and beer.

CONFUSIONS

- 2,4,6-Trichloroanisole
- 2-Bromophenol
- 2,6-Dichlorophenol

IMPORTANCE

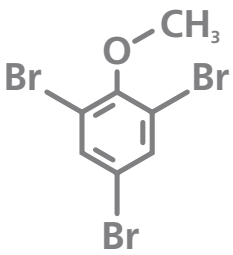
Taint in beer. Associated with a high degree of consumer rejection, even at low levels. Often described by consumers as ‘chemical’ or ‘contaminated’.

REMARKS

2,4,6-Tribromoanisole is one of several bromoanisoles that can taint beer. The flavour produced by this compound is typical. The same compounds are also responsible for ‘cork taint’ in wine.

CAS NUMBER

607-99-8



Musty

“like corked wine with a rubbery overtone”

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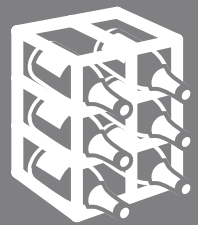
flavour standard

2,4,6-trichloroanisole



Musty

"like corked wine or a damp cellar"

ASSESSMENT

Without covering the glass, swirl the beer to release the aroma. Take a single short sniff. Repeat as necessary.

THRESHOLD

10 – 500 ng / l

ORIGINS

Associated with use of recycled wood and cardboard. Can migrate across packaging materials to contaminate raw materials, filter aids, and beer.

CONFUSIONS

- 2,4,6-Tribromoanisole
- Acetaldehyde
- 2,6-Dichlorophenol

IMPORTANCE

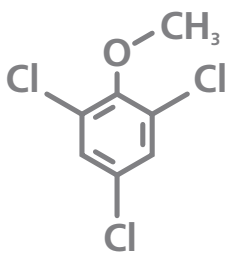
Taint in beer. Associated with a high degree of consumer rejection, even at low levels. Often described by consumers as 'chemical' or 'contaminated'.

REMARKS

2,4,6-Trichloroanisole is one of several chloroanisoles that can taint beer. The flavour produced by this compound is typical. The same compounds are also responsible for 'cork taint' in wine.

CAS NUMBER

87-40-1



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beer

flavour standard

vanillin

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

200 µg/l

ORIGINS

Vanilla flavour notes arise in beer in several ways. Ageing on wood; addition of flavour essences; the action of wild yeasts; and breakdown of certain phenolic compounds during beer storage.

CONFUSIONS

- 4-Vinyl guaiacol
- Benzaldehyde
- 2,3-Butanedione

IMPORTANCE

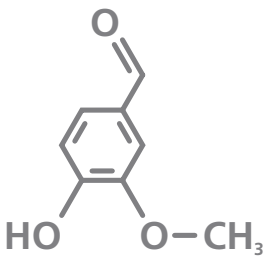
Positive flavour note in speciality ales and stouts. Imparts a creamy aroma and contributes to a smooth mouthfeel, reducing the harshness of components derived from roasted malts.

REMARKS

Can be found as an ageing character in wheat beers and in beers which have been contaminated with wild yeasts.

CAS NUMBER

121-33-5



Vanilla

"like ice cream or custard"

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beer

flavour standard

4-vinyl guaiacol

Phenolic

"like cloves or wheat beer"

ASSESSMENT

Cover the beer with your hand and swirl the glass to release the aroma. Remove your hand and take a single long sniff. Repeat as necessary.

THRESHOLD

300 µg/l

ORIGINS

Low levels of this flavour are produced during wort production. High levels result from use of speciality yeast strains or contamination of beer with wild yeasts.

CONFUSIONS

- Isobutyraldehyde
- Sulphur dioxide
- Vanillin

IMPORTANCE

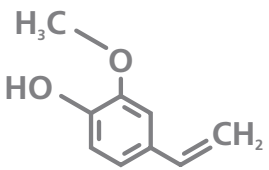
Key flavour impact character in some ales and stouts. Off-flavour in lager beers when it is associated with a moderate degree of consumer rejection. Signature flavour character in German-style wheat beer.

REMARKS

4-Vinyl guaiacol (4-VG) is produced by yeasts which possess the phenyl acrylate decarboxylase (PAD) gene. The enzyme associated with this gene produces 4-VG from barley-derived ferulic acid.

CAS NUMBER

7786-61-0



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