**2,3-butanedione**

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

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

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

**CAS NUMBER**
75-18-3
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.

**Assessment**

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

**Importance**
Present in all beers. Characteristic flavor of some beer styles, e.g. Bière de Garde. Off-flavor at high concentrations.

**Remarks**
The flavor impact of acetaldehyde is influenced by the sulphur dioxide concentration in the beer.

**CAS Number**
75-07-0

**Flavor Threshold**
**beer flavor standard**

### 3-methyl-2-butene-1-thiol

**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-flavor associated with exposure to light of beer packaged in clear or green glass. Consumers are very tolerant of this off-flavor. Many successful beers contain this flavor 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 flavor 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-flavor in beer associated with ageing. Formation of this flavor 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 flavor impact.

**CAS NUMBER**

18829-56-6
beer
flavor standard
infection

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

**THRESHOLD**
Different for each component

**ORIGINS**
Improperly cleaned draft lines can harbor bacteria that release several off-flavors into beer.

**CONFUSIONS**
- Acetic acid (Vinegar)
- Diacetyl

**IMPORTANCE**
This combination of flavors indicates poor draft system sanitation.

**REMARKS**
This standard includes multiple flavors: acetic acid, 2,3-butanedione and citric acid.

**INFECTION:**
Components are acetic acid, citric acid and 2,3-butanedione

“Infection
“like bile, or stomach acid.”

% POPULATION
FLAVOR THRESHOLD

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