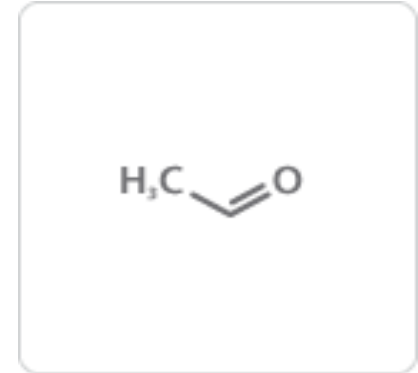


Acetaldehyde

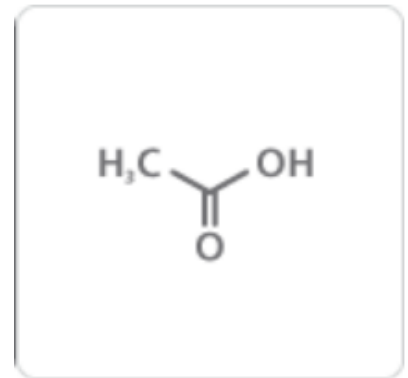
- ▲ Positive flavour in some beers - off-flavour in others
- ▲ Produced by yeast during fermentation
- ▲ Critically affected by wort [Zn] and yeast health
- ▲ Can also be produced by contaminant bacteria and as a result of beer oxidation
- ▲ flavour threshold 5 mg/l



Acetic

Acetic

- ▲ Positive flavour in some beers – off-flavour in most beer types
- ▲ Produced by all yeast
- ▲ Concentration depends on yeast strain and growth
- ▲ Can also be produced by contaminant bacteria
- ▲ flavour threshold 90 mg/l



Bitter

BITTER

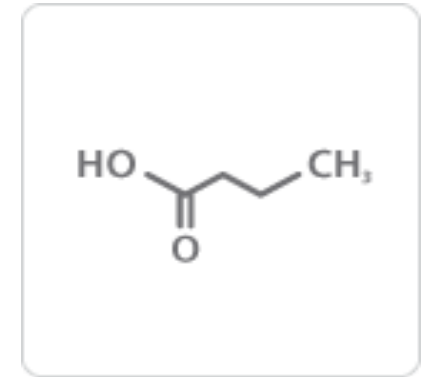


- ▲ Positive taste in beer
- ▲ Contributed by hops or hop extracts
- ▲ Hop alpha acids converted to iso-alpha-acids in prior to delivery to the brewery or in the wort kettle
- ▲ Six different iso-alpha-acids, together with a wide range of related compounds contribute to this characteristic
- ▲ Laboratory measurements expressed as International Bitterness Units (IBU)
- ▲ flavour threshold 3 - 5 mg/l

Butyric

butyric

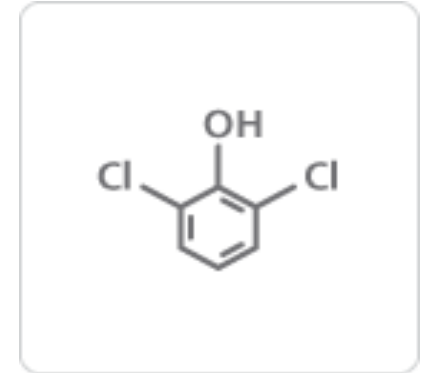
- ▲ Off-flavour in beer
- ▲ Produced by bacteria in mashing or in sugar syrup
- ▲ Flavour not obvious in wort but appears after fermentation
- ▲ Can also be produced by contaminant bacteria – *Bacillus* and *Clostridium* spp
- ▲ Flavour intensity increases as beer pH value is reduced
- ▲ Flavour threshold 3 mg/l



Chlorophenol

chlorophenol

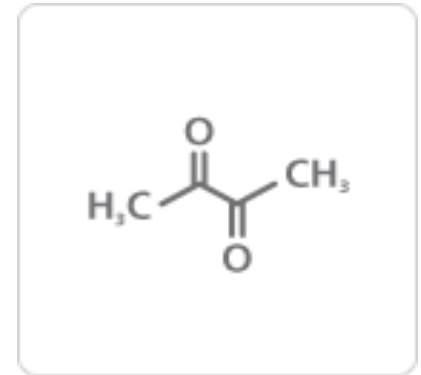
- ▲ Taint in beer
- ▲ Contributed to beer through contaminated water and water treatment media, and reaction with cleaning agents
- ▲ Originates through reactions between chlorine and phenolic compounds
- ▲ Flavour threshold 300 ng/l



Diacetyl

Diacetyl

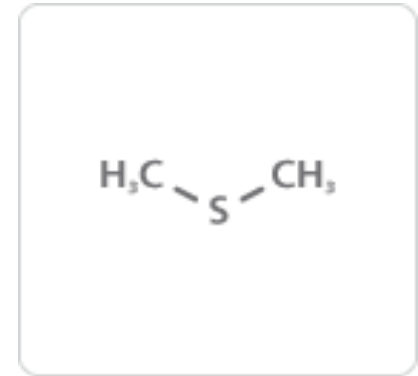
- ▲ Positive flavour in some beers - off flavour in other beer types
- ▲ Precursor is produced by yeast during fermentation
- ▲ Influenced by wort amino acid concentrations and beer pH value
- ▲ Can also be produced by contaminant bacteria – *Lactobacillus* and *Pediococcus* spp
- ▲ flavour threshold 0.01 mg/l



DMS

DMS

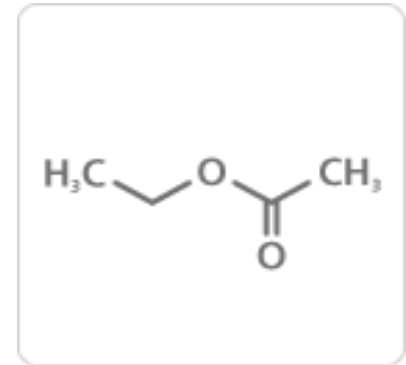
- ▲ Positive flavour in some types of beer - off-flavour in other beer types
- ▲ Derived from precursors in malt
- ▲ Dimethyl sulphide from *S*-methyl methionine
- ▲ Concentration depends on malt specifications, brewhouse procedures and fermentation practices
- ▲ Can also be produced by contaminant microorganisms
- ▲ flavour threshold 0.03 – 0.05 mg/l



Ethyl acetate

ETHYL ACETATE

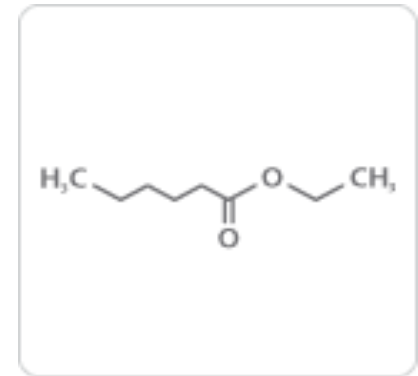
- ▲ Positive flavour in beer – off-flavour at high concentration
- ▲ Produced by yeast during fermentation
- ▲ Concentration depends on yeast strain, wort quality and fermentation conditions
- ▲ Especially dependent on fermentation temperature - can also be produced by contaminant wild yeasts
- ▲ flavour threshold 10 mg/l

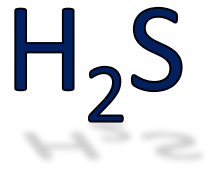


Ethyl hexanoate

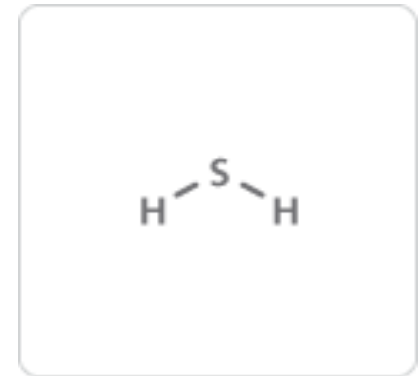
ΕΘΥΛΙ ΗΕΞΑΝΟΑΤΕ

- ▲ Positive flavour in beer - off-flavour at high concentration
- ▲ Produced by yeast during fermentation
- ▲ Concentration depends on yeast strain and fermentation conditions
- ▲ Especially dependent on yeast health and yeast generation number
- ▲ Used to gauge yeast health





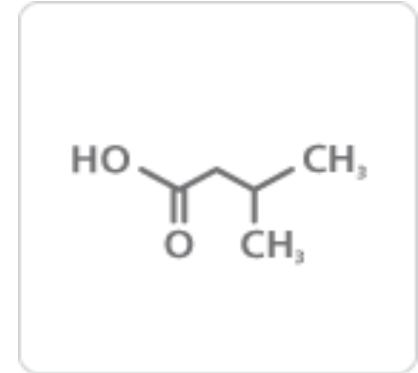
- ▲ Positive flavour in beer - off-flavour at high concentrations
- ▲ Produced by yeast during fermentation and maturation
- ▲ Concentration depends on yeast strain, yeast health and fermentation conditions
- ▲ Can also be produced by contaminant microorganisms
- ▲ Flavour threshold 0.004 mg/l



Isovaleric

ISOVALERIC

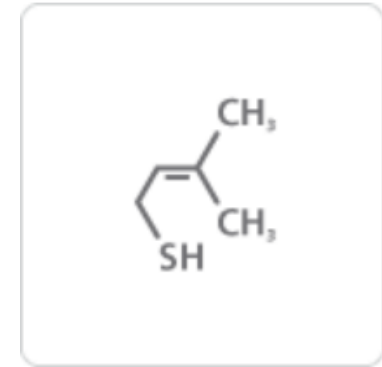
- ▲ Off-flavour in lager beer – positive character in some types of ale
- ▲ Contributed by hops or hop extracts
- ▲ Concentration depends on recipe, hop product and variety, and age of hops or hop product
- ▲ Can also be produced by contaminant wild yeasts
- ▲ flavour intensity increases as beer pH value is reduced
- ▲ flavour threshold 3 mg/l



Lightstruck

ЛІГНІСТРУК

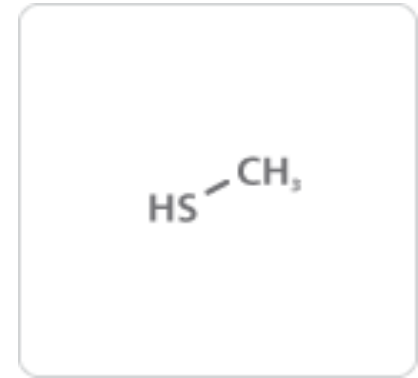
- ▲ 3-methyl-2-butene-1-thiol
- ▲ Formed by exposure to light
- ▲ 'Sunburn for beer'
- ▲ Initiates a reactions involving bitter acids and sulphur compounds
- ▲ flavour threshold 4-30 ng/l



Mercaptan

mercaptan

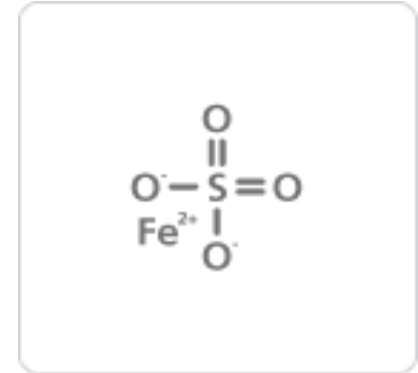
- ▲ Off-flavour in lager beer – positive flavour in craft ale
- ▲ Produced by yeast during maturation or contributed to beer by dry hopping
- ▲ Thiols such as methanethiol
- ▲ Concentration depends on yeast strain, yeast health, fermentation conditions and hopping regime
- ▲ Can also be produced by contaminant microorganisms
- ▲ Flavour threshold 0.0015 mg/l



Metallic

Metallic

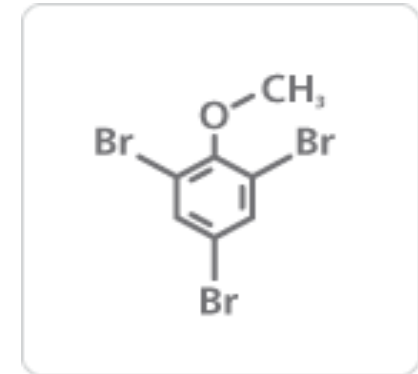
- ▲ Taint in beer
- ▲ Contributed to beer through contamination with metal ions, either from raw materials or corrosion of brewery equipment
- ▲ Iron, copper and manganese can all give metallic flavours
- ▲ Detected by 'trigeminal' sense and by odour
- ▲ flavour thresholds in the region of 0.05 – 0.3 mg/l



Musty

W1227

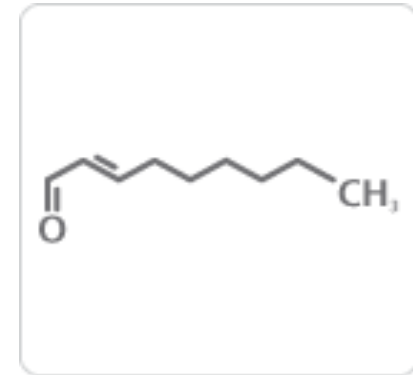
- ▲ Taint in beer
- ▲ Contributed to beer through contaminated raw materials, filter aids, processing aids or packaging materials
- ▲ 2,4,6-Trichloroanisole
- ▲ Originates through conversion of environmental chlorophenols to chloroanisoles by moulds
- ▲ 'Cork taint' in wine
- ▲ flavour threshold 10 – 500 ng/l



Papery

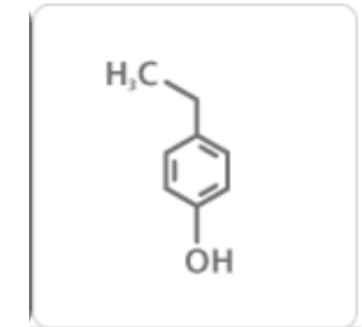
Yester

- ▲ *trans*-2-Nonenal
- ▲ Produced by breakdown of malt-derived lipids - binds to malt proteins during wort boiling
- ▲ Released from protein during storage of packaged beer
- ▲ Beer pH controls rate of release – yeast controls the beer pH value
- ▲ flavour suppressed by sulphur dioxide
- ▲ flavour threshold *ca* 50 ng/l



Phenolic – 4-ethyl phenol

- ▲ Positive character in some beer styles
- off-flavour in most styles
- ▲ Produced by *Brettanomyces* yeasts
- ▲ Occasionally produced by LAB
- ▲ Indicative of contamination in most beer styles
- ▲ flavour threshold 300 µg/l



Phenolic - 4-vinyl guaiacol

- ▲ Positive character in some beer styles
- off-flavour in lager beer
- ▲ Produced by *Saccharomyces* and *Brettanomyces* yeasts
- ▲ These yeasts possess the PAD gene which codes for production of phenyl acrylate decarboxylase
- ▲ Low levels can be produced from malt-derived precursors in the brewhouse
- ▲ flavour threshold 0.3 mg/l

