



The Northern Craft Brewers

"We Live We Brew"



Beer Flavours: Acetaldehyde

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Ever had a beer that tastes a bit “green” or apple-like? Well that’s probably acetaldehyde, an organic chemical with the chemical formula CH_3CHO (Molecular formula $\text{C}_2\text{H}_4\text{O}$). Acetaldehyde is also known as acetylaldehyde, ethanal, ethyl aldehyde and acetic aldehyde. It is a colourless but flammable liquid with a fruity smell and occurs naturally in ripe fruit, coffee, yoghurt and fresh bread, being produced by plants and yeast as part of their normal metabolism. Its flavour can be described as that of apple, orange and even yoghurt or butter-like, with a flavor threshold of about 10 Mg/L, (parts per million) and a normal presence in the range of 1 to 15 Mg/L.

In the production of beer acetaldehyde is the last compound encountered before alcohol, as the yeast converts sugars derived from malted barley, to alcohol. The last steps in fermentation involves yeast cells converting pyruvate into acetaldehyde, which is then converted into ethanol, more commonly known as alcohol. So if your beer tastes “green”, more fruity, or apple-like than expected, then the cause may be that the beer has been put on too soon before it is fully fermented and mature. Bacterial contamination can also ferment malt sugars to acetaldehyde, but this is then likely to be accompanied by a range of other flavours associated with contaminated beer. Inadequate oxygenation of the wort prior to fermentation is often the cause of acetaldehyde, as pyruvic acid, fatty acids and amino acids (protein) are decarboxylated to aldehydes. Without enough oxygen, these are excreted by the yeast cells and whilst they may be reabsorbed by the yeast later, they are just as likely to stay in the beer, resulting in fusel alcohols, and/or remain after fermentation ceases, as predominantly acetaldehyde, giving that “green apple” aroma.

As an interesting digression, once in the body the latter stages of alcohol production are effectively reversed, as in the liver the enzyme alcohol dehydrogenase converts ethanol into acetaldehyde, which is then converted by acetaldehyde dehydrogenase and glutathione into relatively harmless acetic acid. If a lot of alcohol is consumed in a short period the liver runs out of glutathione and acetaldehyde levels build up - and unfortunately acetaldehyde is toxic, resulting in the common hangover symptoms of headaches and vomiting. Although body weight is a factor, it seems that women have less of the enzymes that break down alcohol, making their hangovers worse if they match men beer for beer. Some of the other hangover symptoms such as fatigue, stomach irritation and feeling generally awful, can be attributed to glutamine rebound. Seems to me to be another reason to avoid drinking to excess, whilst enjoying some flavourful beers regularly - but in moderation!