



The Northern Craft Brewers

"We Live We Brew"



Beer Flavours: Acidity

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A beer's overall "flavour" can be viewed as a combination of aroma and taste. Acidity is one of the four primary tastes of sour (acid), bitter, salt and sweet. Let's avoid the controversy of whether Umami is a fifth primary taste for now. If your beer is "off" the chances are that the most likely reason that the flavour is not right is an excess of acidity, as the beer is "on the turn" – turning into a form of hopped malt vinegar, due to increasing levels of Acetic acid.

The sourness of acidity is perceived mainly on the sides of the tongue and to some extent in the centre, but is frequently confused with bitterness (from the hops) that is perceived mainly at the back of the tongue. Acidity can be measured and stated as Titratable Acidity or Total Acidity, with the result given as a percentage, parts per thousand, or grams per litre. Whilst this is useful for winemakers, it is less so to brewers, where brewing reactions are sensitive to the active acid present and not the actual quantity as determined by titration.

In brewing acidity is measured on the pH scale, from 0 (acid) to 14 (alkaline), where 7 is neutral (pure water). Interestingly the pH scale was devised by Danish chemist Sorensen at Carlsberg! pH stands for the power of hydrogen, a measure of the activity of dissolved hydrogen ions. This is a negative logarithmic scale of the concentration of hydrogen ions in solution, where every step on the scale represents a multiplication of 10. So lemon juice which has a pH of about 2 is 10 times more acidic than vinegar with a pH of 3.

Within the human body there is a wide range of pHs, from the stomach at 2, to the intestines at 8. Whilst pH is related to the total acidity present, they are not necessarily equivalent due to "buffering", but this is not the place to go into details of water chemistry.

In the production of beer, pH influences the action of enzymes, yeast, fining agents and bacteria. In the mash tun the acidity should be within the 5.0 to 5.6 range with an average aim of 5.3 for English beers. Alpha-amylase prefers a pH of 5.6 and 70 degrees Celsius to start breaking down starches into complex,



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relatively unfermentable sugars; whereas the other major enzyme, beta-amylase, prefers a pH of 5.0 and 60 degrees Celsius to produce simple, fermentable sugars. Thus at the average mash temperature of 66 C, less acidity (higher pH) produces a less fermentable and thus sweeter beer, but if too high more tannin will be extracted, producing a harsh bitterness. Conversely, a more acidic mash (lower pH) produces more fermentable sugar and thus a drier and more alcoholic beer.

Achieving the proper pH in the mash influences the final pH and brings out the flavours of the malt and hops. As in a dry white wine a certain level of acidity is desirable in beer. Insufficient acidity will give a beer that can range from lifeless to harshly bitter. Dark malts will lower the pH more than pale malts but if this is not enough given the initial water supply and the style of beer being brewed, then adjustment to the pH level can be made by the use of various water treatment salts, acids or acidified malt. The pH of the cooled wort should be about pH 5.0 to 5.6.

If you are scientifically inclined by all means measure your pH with paper strips or better still a meter and adjust your pH. If you are more of the brewing is an art philosophy and are happy with your beer, then as the American Homebrewers Association say: relax, don't worry, have a home brew. In my experience if you are using mains water there is unlikely to be any significant problem if you don't measure the pH.

The yeast itself lowers the pH even further and has a beneficial effect by making the beer increasingly less likely to infection by other organisms, although there are a number of bacteria, such as Acetobacter and Lactobacillus species, which can still thrive in the acidic environment of normal beers at pH 3.8 to 4.7. Some of these will make the beer increasingly unpleasant by producing Acetic or Lactic acid but whilst they may ultimately spoil your pint, fortunately they are unlikely to do you any significant harm. The level of Acetic acid for normal beers is 57 to 145 Mg/L (or parts per million if you prefer),



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below the flavour threshold, usually stated as 400 Mg/L (but I have seen figures quoted as low as 170).

Levels of acid that would be unacceptable in English ales would be part of the flavour profile expected in Belgium lambics, where the pH may drop to 3.2, with around 1,500 to 3,500 Mg/L of Lactic acid – well above the flavour thresholds. If you have not tried lambics try Cantillon Gueuze if you want to discover what an intentionally sour beer tastes like.