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Developing a taste for Acidulants

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While food acids such as citric acid are commonly used in food products, many technologists and manufacturers often overlook the impact of acid selection on the flavour of the final product.

While food acids usually have a significant impact on the stability of foods by reducing pH, some products can taste better. Products with a pH below 4 are generally recognised as being high acid foods and are not a major risk for the growth of pathogenic bacteria.

The control of pH is also important for many ingredients such as stabilisers. High methoxyl pectins, used in the manufacture of jam products, require a pH range of 3.0 to 3.4 to achieve optimum gel strength. Lowering the pH of food systems can also retard the activity of some enzymes involved in the discolouration of fruits and vegetables.

pH also has a significant influence on the development of colour, particularly natural colours. At pH 2 the natural colour carmine is Strawberry red, at pH 4 it is Raspberry red and at pH 7 it develops pale pink hues. Carmine will generally precipitate in a pH 7 solution.

From a flavour standpoint, the pH range of around 2.4 – 2.8 is about the limit for taste. Anything below this tends to be too tart to be palatable. However products such as fruit fillings or jams with 65% sugar will be more acceptable than unsweetened beverages at this pH range. Using the correct sugar-to-acid ratio softens the impact of the acidity. If the balance is right the product is not perceived as being excessively sour.

Some acidulants tend to impart their own characteristic flavour, with acetic acid, or vinegar, being good examples. Both acetic acid and lactic acid have an anti-microbial effect and are the basis for preservation by fermentation in products such as sauerkraut and pickles.

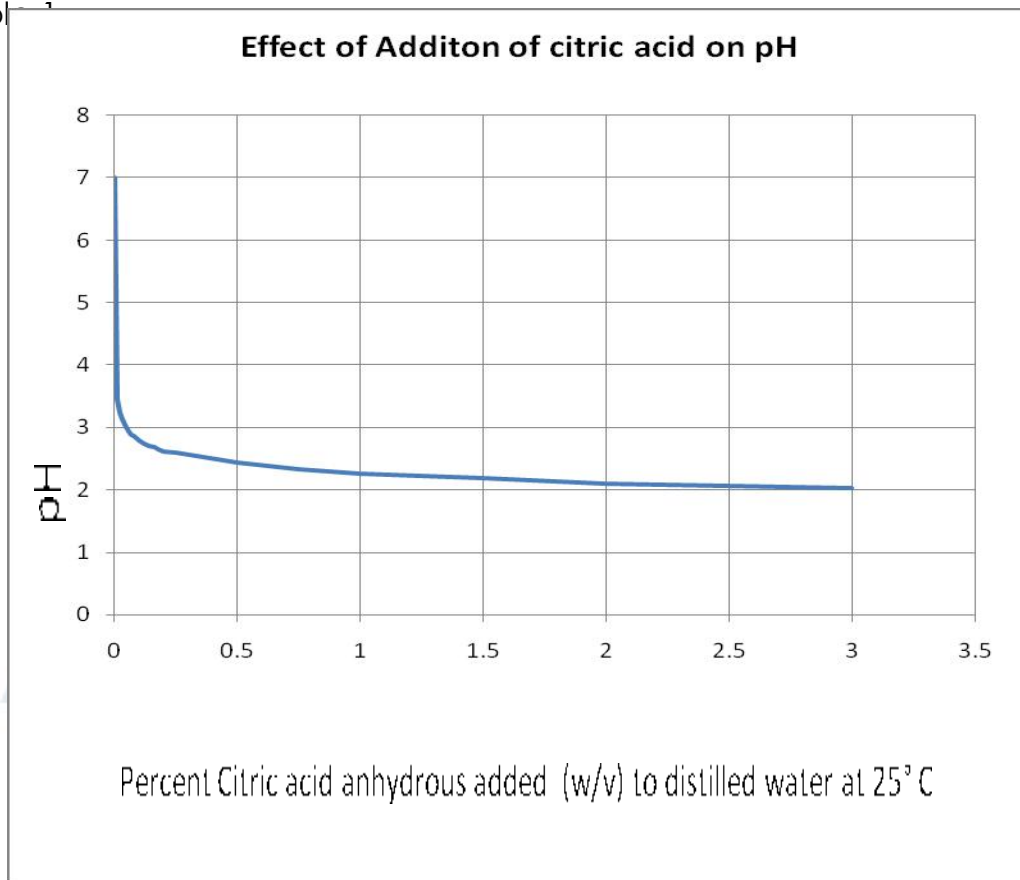
The profile of the acid should match the profile targeted in the final product. Often the best flavour is achieved by using the acid usually associated with a particular food. For example citric, malic and tartaric acids typically give the best flavour perception in fruit flavoured products.



Common Acidulants

The most commonly available acidulant is citric acid. Found naturally in citrus fruit such as lemons and limes, approximately 900,000 MT per annum of citric acid is manufactured by fermentation. Anhydrous citric acid is very soluble in water and has a pH of 2.3 for a 1% solution. It is relatively hygroscopic and has a strong acid tart flavour. Citric acid is used in many fruit and beverage applications.

Table 1



Typical citric acid content of selected fruit and vegetables

Blackcurrants	1.5 - 3.0%
Grapefruit	1.2 - 2.1%
Lemons	4.0 - 8.0%
Oranges	0.6 - 1.0%
Raspberries	1.0 - 1.3%
Red currants	0.7 - 1.3%
Strawberries	0.6 - 0.8%
Tangerines	0.9 - 1.2%
Apples	0.01%
Asparagus	0.08 - 0.2%
Corn Kernels	0.02%
Peas	0.05%
Potatoes	0.3 - 0.5%
Tomatoes	0.25%
Turnips	0.05 - 1.1%

Tartaric acid is an acidulant derived from grapes, and is very soluble in water. It has a slightly tarter taste profile than citric acid, and is often used in grape and lime flavoured beverages. Only natural L-(+) tartaric acid is permitted for food use. While tartaric acid can be manufactured synthetically, it does not meet the FCC requirements for optical rotation $[\alpha]^{25}_D$ of $+12.0^\circ$ to $+13^\circ$ and is therefore not permitted.

Lactic acid is normally associated with acidified dairy products such as yoghurt. It is a syrupy liquid available as 80 or 88% liquid form and is classified as a "Class 8" corrosive liquid under Dangerous Goods legislation. It is heat-stable, non-volatile and has a smooth milk acid taste. It is often used to provide buttery notes to beverages and dairy products and reduce the pH below pH 4 without adversely affecting the flavour of the food product.

Malic acid is naturally found in apples, tomatoes and plums and has a sourer perception than citric acid. Products containing citric acid can often be reformulate with about 20% malic acid and still achieve the same level of sourness. Malic acid has also been used to complement the flavour profile of high intensity sweetener systems

Specialty Acidulants.

Adipic acid is widely used in powdered products due to its stability during extended periods of storage. It has a similar acidity profile to citric acid and is used as a leavening acidulant in baking powder and as a buffering agent to maintain acidity within a pH range of 2.5 to 3.0.

Fumaric acid is considered to be the strongest organic food acid in sourness and titratable acidity. It has low solubility and has low hygroscopicity: it absorbs virtually no atmospheric moisture and is well suited to coatings in confectionery products and powder mixes.

Glucono-delta-lactone is often abbreviated to “GDL”, not to be confused with Gluconolactone, D-glucono-3,6-lactone, or DGL. GDL hydrolyses to form gluconic acid in water and thereby creates the desired pH. The rate of acid formation is affected by temperature, concentration and the pH of the solution. It has low acid release at room temperature and accelerates the conversion to gluconic acid as the temperature increases. GDL is readily soluble in water and is used as a chemical leavening agent in tofu and also as a pH modifier in smallgoods such as sausages and frankfurters. It is thought to be one of the best acids to reduce pH without giving an excessive acidic flavour profile to the food product.

Despite being widely used in cola beverages phosphoric acid is not commonly used in many other food applications. It gives a “tangy” sourness and can be used in high fruit applications to balance the metallic flavour profile.

Acidulant Solubility at 20°C	Solubility (g / 100mls)
Citric acid	59.2
Tartaric acid	58.2
Malic Acid	56.0
Adipic Acid	1.4
Fumaric acid	0.6

Selection of the correct acidulant can have a significant impact on the final flavour profile and the stability of the food product. An assessment of the requirements of the final product along with the characteristics of the available acids can have a significant impact on the final flavour delivery.

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