

# ACIDULANT SELECTION

*The most important factor when narrowing down the selection of acidulants for beverages is the impact on taste and flavour.*

by Daniel R. Sortwell

There are seven beverage acidulants in commercial use. These are Citric, Fumaric, Lactic, Malic, Phosphoric, and Tartaric Acids, and the recently introduced, Sodium Acid Sulphate.

The most important factors to be considered when narrowing down the selection of acidulants for a particular beverage formulation from seven to two or three acidulants, is the impact on taste and flavour. Acidulants have unique taste and flavour effects, as shown in the table 1. The relative sourness of the acidulants at pH 3.0 is depicted by the sourness bar chart. Acid and Sodium Acid Sulphate are

much less sour than the other acidulants at pH 3.0. For this reason, they are used to lower pH with a minimal increase in sourness. Phosphate and Citrate buffer salts are less sour than Lactate buffer salts and would be selected when buffer salts with minimal sourness are required.

#### HANDLING AND STORAGE

All beverage acidulants except Fumaric Acid are highly soluble in water. High shear mixing stations of the type used to dissolve aspartame are used to increase Fumaric Acid's dissolution rate.

Phosphoric Acid is a corrosive liquid.

Additional safety precautions are necessary when handling Phosphoric Acid.

All of the solid beverage acidulants except Fumaric Acid are hygroscopic.

#### FACTORS

If the beverage being formulated has many years of exposure to consumers in the marketplace, then a radical change in the acidulant(s) is not recommended. A major change in the flavour profile would result, since acidulants have different flavour effects. If the product is a calcium fortified beverage, Tartaric Acid or grape juice concentrate should be avoided, since Calcium Tartrate would precipitate. If a tea

concentrate is used as the basis for a Calcium fortified tea beverage, Calcium Oxalate would precipitate. In this case, tea distillates or extracts can be used.

If the required pH is less than 3.5, the use of weak acids such as Lactic Acid as the primary acidulant would result in a very sour beverage.

#### ACIDULANTS CURRENTLY USED

Acidulants and acidulant combinations currently used in beverages are shown in table 2. The beverages used as the basis for this diagram include carbonated soft drinks, still beverages, dry beverage mixes, enhanced waters, energy drinks, and alcoholic drinks. This diagram also shows the order of the acidulants. For example, CM indicates that Citric Acid is the primary acidulant and that Malic Acid is the secondary acidulant. Table 2 reveals three patterns:

1. In all beverage types except cola, Citric Acid is most often the primary acidulant. Phosphoric Acid is the primary acid in cola beverages.

2. In all beverage types except cola, Malic Acid is most often the secondary acidulant. The CM combination (Citric Acid as the primary acidulant and Malic Acid as the secondary acidulant) is the most widely used acidulant combination.

3. Malic Acid is more often used in combination with the high intensity sweeteners shown than with nutritive sweeteners. As mentioned earlier, Malic Acid has a more persistent sourness than Citric Acid and therefore complements persistent sweeteners such as aspartame and sucralose, even when used as a secondary acidulant.

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**Table 1: Taste and Flavour Effects of Beverage Acidulants**

	Sourness AT Ph 3.0, 0.1% W/V*	Descriptors	Flavour Modifier	Temporal
Citric	■■■■■■■■■■	bright, refreshing	□	∪
Fumaric	■■■■■■■■■■	clean, dry	□□□	∪
Lactic	■■■■■■■■■■	smooth, dairy	□□	∪
Malic	■■■■■■■■■■	mellow, smooth	□□□□	∪
Phosphoric	■■■■■■■■■■	low impact	□	∪ <sup>-</sup>
SAS	■■■■■■■■■■	low impact	□□	∪
Tartaric	■■■■■■■■■■	brusque, dry	□	∪ <sup>-</sup>

\*Estimated using Bartek sourness models. See the Self Teaching Guide for Food Acidulants.

**Table 2: Acidulants Used in Beverages**

	NUT	APM	APM/ ACE-K	SUC	SUC/ ACE-K
Cola	P PC PL	P PC PL	PC		
Root Beer, Ginger Ale, Cream Soda	C	C CM		CM	
Tea with Fruit	C CP M	C CM M MC	CM CP	MC	
Fruit	C CFP CL CM CMT CP F FC L M MC MPC	C CM CMT M MC	C CM M TM	C CM M	C CM CPM M PCM

**Legend**

C= Citric and/or Citrate  
 F= Fumaric  
 L= Lactic  
 M= Malic  
 P= Phosphoric and/or Phosphate  
 T= Tartaric  
 NUT= Nutritive Sweetener  
 APM= Aspartame  
 APM/ACE-K= Aspartame/Acesulfame-K  
 SUC= Sucralose  
 SUC/ACE-K= Sucralose/Acesulfame-K