BARTEK

The Advantage of Using Bartek Malic Acid with High Intensity Sweeteners in Beverages

Malic acid, a dicarboxylic acid, also known as "apple acid", is a naturally occurring acidulant that represents all or most of the acids in apples, watermelons, cherries, plums, grapes, broccoli and a variety of other fruits and vegetables. ***Malic acid*** is the second most dominant acid in citrus fruits.

Food acids like ***malic***[1] perform important functions in beverages—

- provide tartness/sourness
- enhance and modify flavours
- increase thirst quenching effect by stimulating saliva flow in mouth
- modify sweetness of sugar/other sweeteners
- buffer beverages in the form of buffering salts
- pH adjustment
- chelate trace metal ions
- act as mild preservative via pH lowering effect
- increase effectiveness of preservatives
- act as synergists to antioxidants

Malic acid was introduced to the US food industry in 1922, but its commercial availability occurred in 1964. Because citric acid has been used commercially for 100 years, it is the acid that was traditionally selected for beverage formulations.

Because consumers are demanding newer, better and different tasting beverages, it is time to seriously consider using other acidulants. New Age beverages like sport drinks, fruit-juice base drinks, iced teas, carbonated fruit-juice drinks, flavored colas, etc. in exotic flavors like passion fruit, lychees, kiwi, and blends of such fruits have placed a demand on the formulators to select the most appropriate sweeteners and food acidulants to best mimic mother nature's flavours consistently.

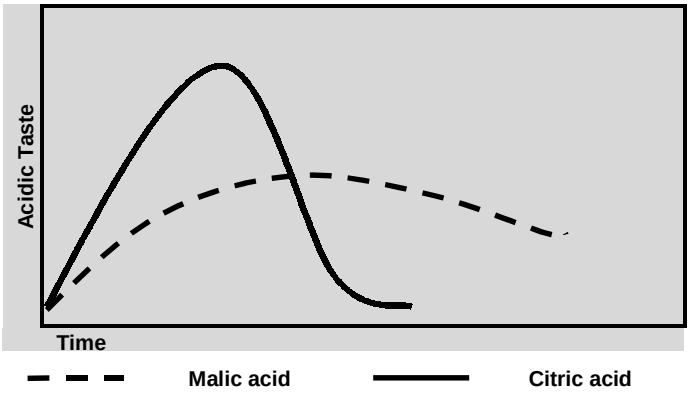
Bartek Malic Acid's Attributes

Acid Flavour

The **sourness** perception of ***Malic acid*** tends to linger over a longer period of time than citric acid. This **prolongation/retention effect** offers unique advantages in masking the undesirable aftertastes of some low calorie sweeteners; and gives the perception of a higher acid intensity.

Citric acid imparts a quick (or sharp) tart taste of high intensity that dissipates rapidly over time. [Graph below]

Taste Retention



Malic acid's prolonged sour taste allows for the blending of several fruit flavours so a new combined flavour can be achieved.

Acid Strength and Sourness

Sowalsky & Noble[3] confirmed in a study of four organic acids that "sourness is independently influenced by concentration, pH, and anion species of the acid." Sourness models developed by Bartek to fit sensory data reveal that relative

sourness between acids changes with pH, as shown in the table below:

Sourness Equivalent Value* vs. pH

Acid	Sourness Equivalent Value	
	At pH 3.0	At pH 4.0
Citric	1.00	1.00
Fumaric**	0.68	0.97
Lactic	0.76	1.22
Malic**	0.71	0.82
Tartaric	0.88	1.29

* grams of organic acid needed to provide equivalent sourness to 1.00 gram of Citric Acid in 500 grams of beverage.

** Bartek manufactures both Malic and Fumaric Acids.

Malic acid provides more sourness than most other organic acids over a wide pH range.

Intense Sweeteners

Using ***Malic acid*** as the acidulant in calorie reduced beverages can result in a smoother, more palatable drink. For instance, up to 10% less aspartame can be used in formulas.[4] Acidulants are used in beverages to offset the "sweet" taste of the sweetener—to create an appetizing sweet-sour balance.

For example, blends of ***Malic*** and citric acids have also been found to work well in aspartame sweetened citrus and berry-flavored drinks. Citric acid delivers a quick initial impact while ***Malic acid*** provides a delayed sourness effect.

Malic acid improves aftertaste by extending the impact of sourness as well as some flavour notes. This is especially important in beverages containing saccharin, cyclamates, and acesulfame-K.

The *MALIC ACID* ADVANTAGES:

- **ITS FLAVOUR ENHANCEMENT PROPERTIES AND PERSISTENT SOURNESS IMPROVE AFTERTASTE IN MANY BEVERAGE SYSTEMS;**
- **ITS MELLOW, LESS SHARP, MILD ACID TASTE ENHANCES THE BEVERAGE'S TASTE WITHOUT OVERPOWERING THE FLAVOUR SYSTEMS;**
- **ITS EXTENDED SOUR TASTE MEANS LESS *MALIC ACID* CAN BE USED IN BEVERAGE FORMULAS; AND**
- **ITS TART, SMOOTH, LONG LASTING FLAVOUR PROFILE HAS SYNERGY WITH ASPARTAME AND SUCRALOSE—ABOUT A 10% REDUCTION IN THE USE OF THESE SWEETENERS CAN BE ACHIEVED.**

(Note: The usage allowance of the various high intensity sweeteners depends on the Food and Drug Regulations of the individual country where the beverages will be consumed.)

References:

1. Jindra, J. 1989. "Acid mix." Food Flavourings Ingredients Processing Packaging. 12:43.
2. Overview—Sensory Symposium. 1991. "Sweet taste: Basic mechanisms and applications. Food Technology. Nov. 108-145.
3. Sowalsky, R.A. & Noble, A.C. 1998. "Comparison of the Effects of Concentration, pH and Anion Species on Astringency and Sourness of Organic Acids." Chemical Senses 23:343-349.
4. Duxbury, D. 1986. "Ingredients: Malic acid/aspartame synergy reduces sweetener usage 10% in diet drinks." Food Technology.

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