



**BARTEK**

# Malic Acid in Citrus Fruits

Fruits of the *Citrus* family are sour due to the presence of Citric and Malic Acids. When formulating citrus-flavoured food or beverage products, it is useful to examine the relative levels of Citric and Malic Acid naturally present in the fruit. The use of low levels of Malic Acid in citrus-flavoured beverages results in a stronger fruit flavour and in a rounded, more natural flavour profile.

Malic Acid is present in the juice of all citrus fruits. As shown in the table below, Malic Acid is normally the secondary acid in citrus fruit juices, Citric Acid being the primary acid. The level of Malic Acid in citrus juices varies by type of fruit, growing region, and fruit variety.

The ratio of Citric to Malic Acid in the citrus fruits shown below varies from about 30:1 for grapefruit to 4.5:1 for Brazilian orange. The recommended starting point in citrus beverage formulations is a 95/5 blend of Citric and Malic Acids. A higher proportion of Malic Acid is used in confectionery products and in products containing aspartame or sucralose.

Bartek Ingredients Inc. conducts technical training seminars on the selection and use of acidulants for food and beverage manufacturers. The *Self Teaching Guide for Food Acidulants* is available at [www.bartek.ca](http://www.bartek.ca) or in CD-ROM format by contacting [sales@bartek.ca](mailto:sales@bartek.ca).

Malic and Citric Acid Levels in Citrus Fruit Juices (% w/v ± std. error)

Fruit, Region (variety)	Malic Acid	Citric Acid	sample size, <i>n</i>	Reference*
<b>Lemon</b>				
Israel	0.26±0.03	5.20±0.33	11	Lifshitz, A & Stepak, Y (1971)
California (eureka)	0.22	4.19	2	Clements, RL (1964)
<b>Mandarin</b>				
California (dancy)	0.20	1.04	2	Clements, RL (1964)
<b>Orange</b>				
Brazil first press	0.20±0.02	0.90±0.05	58	Saccani, G et al. (1995)
USA and Cuba	0.16±0.02	0.84±0.13	34	Saccani, G et al. (1995)
Spain (navelina)	0.13±0.01	1.17±0.06	63	Saavedra, L et al. (2001)
Mediterranean	0.12±0.03	1.15±0.10	15	Saccani, G et al. (1995)
<b>Grapefruit</b>				
California (marsh)	0.06	1.79	1	Clements, RL (1964)
Texas (pink)	0.06	1.19	1	Clements, RL (1964)
Various	0.05±0.01	1.59±0.15	28	Saccani, G et al. (1995)
Arizona	0.04	2.10	1	Clements, RL (1964)

\*detailed references are available