

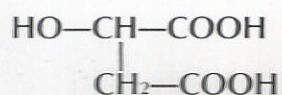
APPLE BRAND MALIC ACID





MALIC ACID is found in various fruits and vegetables as a natural organic acid giving a refreshing sour taste. It also plays an important role for humans and animals in the carbohydrate metabolism system known as Krebs Cycle. MALIC ACID is a harmless substance, classified "Generally recognized as safe (GRAS)" by the FDA and widely used in many countries throughout the world both in the food and industrial fields. It is a highly-valued acidulant to the food industry due to characteristics such as it's being non-volatile, anhydrous, free flowing and non-hygrosopic in nature.

Specifications & Physical Properties



F.C.C. Grade

Specifications

Assay:	99.0% min.
Arsenic (as As):	0.0003% max.
Heavy Metals (as Pb):	0.002% max.
Lead:	0.001% max.
Fumaric Acid:	1.0% max.
Maleic Acid:	0.05% max.
Residue on Ignition:	0.1% max.
Water-Insoluble Matter:	0.1% max.

Physical Properties

Appearance:	White or nearly white, crystalline powder or granules
Molecular Weight:	134.09
Melting Range:	130°C—132°C
Specific Gravity:	1.601 (20°/4°C)
pH of 1% solution:	2.35
Buffering Index	3.26

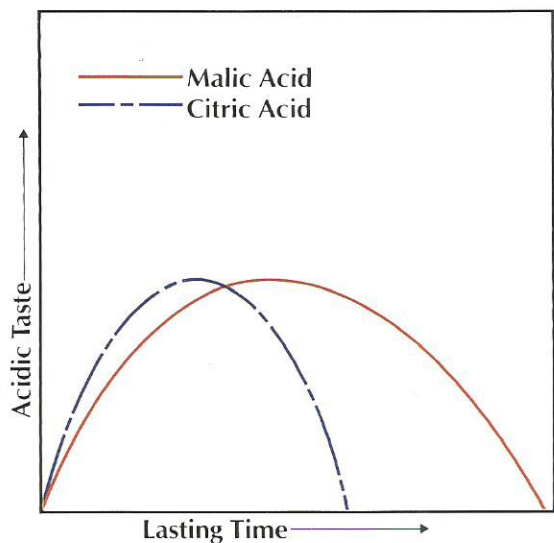


Figure 1. Taste-retention Curves.

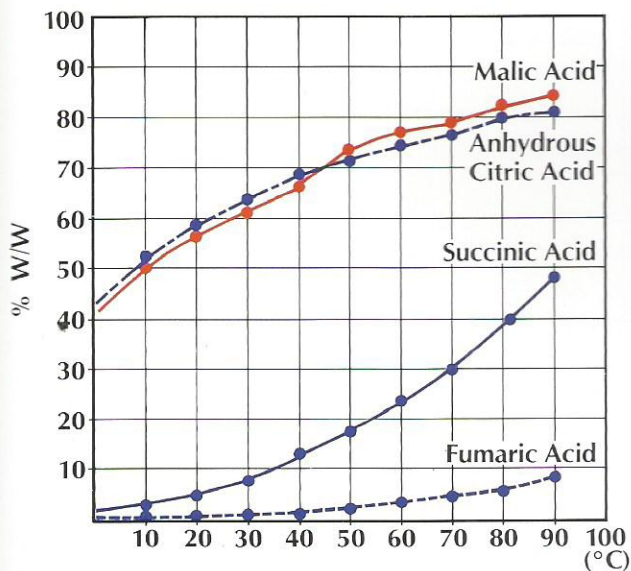


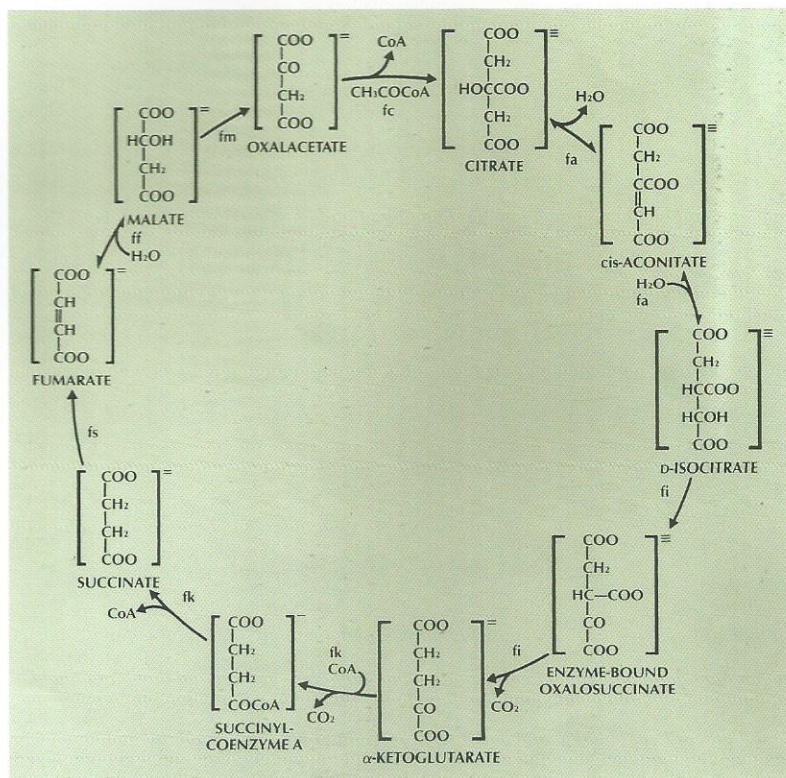
Figure 2. Solubility in water at different temperature.

Why MALIC ACID is a preferred food acid?

After repeated panel tests, it is generally recognized that a given amount of Citric Acid can be replaced by a smaller amount of MALIC ACID.

When utilizing MALIC ACID in current Citric Acid applications, a savings of approximately 15–20% can be realized through experience. This may vary according to each application. Furthermore, the acidic taste portrayed by MALIC ACID, remains longer in the mouth compared with that of Citric Acid. MALIC ACID will help to mask the bitter aftertaste of artificial sweeteners like saccharin and cyclamates as well as the slightly metallic aftertaste of aspartame. The low melting point characteristic of MALIC ACID makes it the preferred acidulant in the production of hard candy. It also has an excellent anti-browning effect towards fruits and other foods.

Stages of the Krebs Cycle



CH₃CO~CoA = Acetylcoenzyme A
CoA = Coenzyme A
fc = Condensation enzyme
fa = Aconitase

fi = Isocitric enzyme
fk = α-Ketoglutaric dehydrogenase
fs = Succinic dehydrogenase
fm = Fumarase

fm = Malic dehydrogenase
ΔF' = Standard free energy change at pH⁷

APPLICATIONS

FOOD

Carbonated beverages sweetened with sucrose:

Depending on the particular flavor, 80—90% of MALIC ACID by weight is sufficient in attaining the same level of acidic taste compared with that of Citric Acid.

Artificially-sweetened carbonated beverages:

Low-calorie or non-calorie carbonated beverages usually incorporate sodium saccharin or sodium cyclamate as the sweetening agent. Therefore, to offset the undesirable after taste produced, MALIC ACID is recommended due to its ability to maintain a prolonged acidic taste within the mouth longer than that provided by Citric Acid. Again, 80—90% by weight of MALIC ACID will replace Citric Acid.

Non-carbonated beverages:

75—90% by weight of MALIC ACID will substitute for Citric Acid in fruit-juice drinks.

Powdered-juice drinks:

For its non-hygroscopic nature, MALIC ACID is used in sugar-sweetened powdered-juice drinks, especially effervescent artificially-flavored powdered-juice drinks in that it masks any bitter aftertastes.

Jams and jellies:

To supplement the deficiency of naturally-contained acids, MALIC ACID is added for better gelling and helps control pH for preservation. Normally a 0.4—0.5% acid-usage level is required in order to adjust the pH whereas Pectin can act most effectively.

Canned fruits and vegetables:

If MALIC ACID is used to lower pH below 5 the sterilization of canned fruits and vegetables can be accomplished at lower temperatures and shorter time, which is vital to avoid texture change and discoloration.

Candy:

In hard candy, 90—95% of MALIC ACID replaces Citric Acid; its lower melting point in comparison to Citric and other food acids helps it to dissolve quite rapidly and provide a literally hard candy. In other candies like jellies, pastes, creams, gumdrops and fruit caramels, MALIC ACID can replace Citric Acid without any formulation change.



Malo-Lactic fermentation and wine making:

Malo-Lactic fermentation is a fermentation defined as the bacterial conversion of MALIC ACID to Lactic Acid and Carbon Dioxide during storage of new wine. It is known that utilization of MALIC ACID for crushed grape juice stimulates the growth rate. Also high-quality wine containing large amount of iso-amyl alcohol and iso-butyl alcohol will be obtained with good fragrance and flavor.

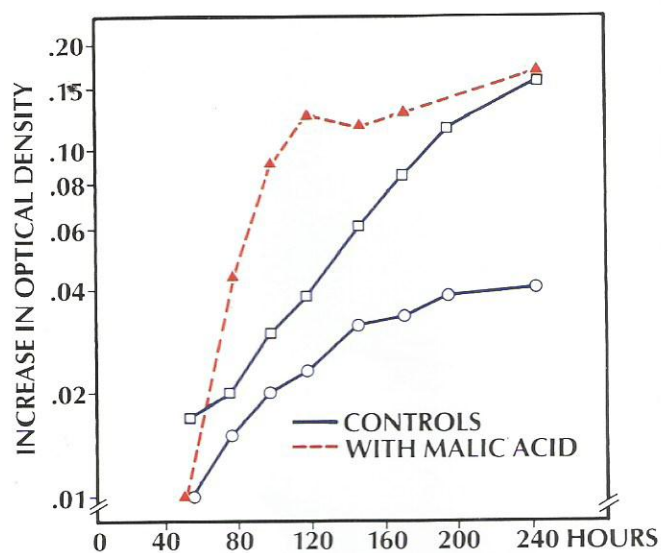
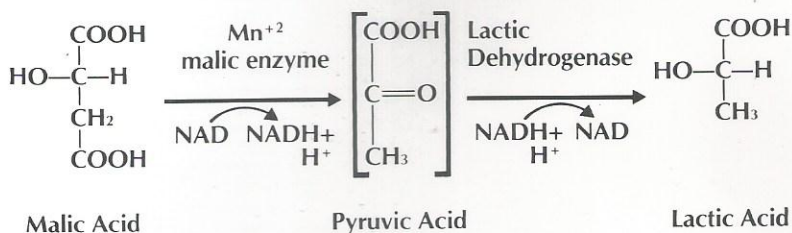


Figure 3. Effect of low pH on growth of *Leuconostoc oenos* ML 34 without malic acid (○, □) and with 0.2% malic acid (Δ).

MORENZONI

Enzymology of Malo-Lactic Fermentation



P.166 & P.173 *Chemistry of wine making*, American Chemical Society, Washington, D.C. 1974

INDUSTRIAL



Deodorant:

Malic acid when reacted with ammonium or mercaptan, change it to a non-odorous substance.

Typical formulation of liquid type deodourant

Malic acid 50% solution	32.50%
Glyoxal 40%	8.75%
Flavour	1.50%
Surfactant	3.00%
Water	54.25%
	100.00%

Dyeing acid in the textile industry:

Compared with acetic acid or formic acid, malic acid is a safe and harmless product without causing erosion of metal-machines, skin disorders or mal-odor problems.

Rust and scale remover:

Replacing the customary strong acids like hydrochloric acid, sulfuric acid and nitric acid, malic acid can be used for the same purpose without toxicity.

Textile finishing agent:

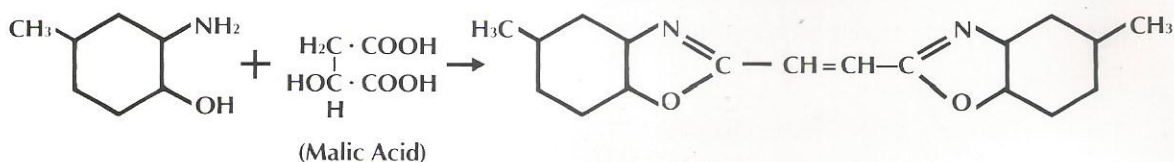
When combined with boric acid, ammonium rhodanide and emulsion type water repellents, a flame retardant textile finishing agent is obtained.

Builder for detergent:

When replacing sodium tripolyphosphate or nitrilo tri-sodium acetate, river and sea water can be protected from abnormal propagation of algae. Also, it is used as a builder for it's chelating function.

Fluorescent brightening agent:

Patent D.B.P. 955683 by Ciba 1957, 1947



GENERAL INFORMATION

International Classifications:

Brussels Nomenclature: 29.16

Standard International Trade Classification: 512.53.

CAS Reg. Number: 617-48-1 & 6915-15-7

EINEC Number: 2105149 & 2300228

Packaging:

25 kg/50 lb multi-wall paper bags with
inner one polyethylene bag.

Other packages are arranged by customers' requirement

Storage condition:

Malic acid can be stored in a dry place. C.R.H. of malic
acid is 76%.