

# 18 Applications

A Deep &  
Entertaining  
Discussion  
About Acids

## The Complete Acidity Meter Guide!

### **A Comprehensive Collection of 18 Applications**

From fruits (citrus, grapes, strawberries, etc.) to alcohol (wine, sake, beer, etc.), dairy products (milk, yogurt, etc.) and vinegar, ATAGO acid meters can measure a wide variety of samples-all 18 applications collected in one book!

### **The Definitive Acidity Meter Guide!**

This guidebook is the bible of selecting acidity meters.

You will soon know everything you need to know about acids and acidity meters!



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## Citric acid is found in high quantities among citrus fruits

### Citrus

For illustrative purposes, mikan (oranges) will be used to represent citrus in general.

An orange's flavor is determined by the balance of sugar and acid. Its "sweetness ratio" (Brix-Acid ratio or sugar / ACID RATIO) can be calculated by dividing the sugar level by the acid level.

**sugar level / acid level = sweetness ratio (Brix-Acid ratio)**

The Brix-Acid ratio will vary depending on the type of citrus, but a Brix-Acid ratio between 12 to 30 is quite common.

When oranges first start to develop, they have low sugar levels and high acid levels. As they continue to grow, their sugar levels increase while their acid levels decrease.

Citrus growers measure the sugar levels daily and then harvest and ship once the fruit is ripe and ready to eat.

Alternatively, the fruit can be kept in storage facilities after harvesting, where its Brix-Acid balance is closely monitored until it reaches an ideal level for shipping. Until recently, there was no quick and easy way of measuring acid level. Citrus growers would occasionally take their oranges to a fruit sorting facility to measure the acid level.

The **PAL-Easy ACID1** or the **PAL-BX|ACID1** allows for quick and easy acid level measurements.

The acid level of oranges ranges from about 0.4 to 1.0%. Citric acid is the main acid found in oranges. When preparing a sample for measurement, filtering freshly squeezed orange juice through a sieve or coffee filter will yield more stable results.

#### Acid Levels of Citrus Fruits (Rough Guide)

Oranges	0.67%
Grapefruit	1.28%

**Recommended Products**

Citrus (Brix-Acidity) <b>PAL-BX ACID1</b> Cat.No.7101	Citrus (Acidity) <b>PAL-Easy ACID1</b> Cat.No.7301	Multi Fruits (Brix-Acidity) <b>PAL-BX ACID F5</b> Cat.No.7100	Multi Fruits (Acidity) <b>PAL-Easy ACID F5</b> Cat.No.7300
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## Tartaric acid is a type of acid found in a number of fruits, particularly grapes.

### Grapes & Wine

#### ● Grapes

Before there was a quick and easy way of measuring acid level, it was common for grape growers to use a pH meter for measurements. As a result of the lingering traces of this practice, "acid level," is sometimes referred to as "pH" value among grape growing regions.

The acid in grapes is comprised of tartaric and malic acid. The ratio (percentage) of these two acids varies depending on the variety of grape and the cultivation process. The acid level is obtained through total acidity to tartaric acid conversion.

The acid level of grapes ranges from about 0.4 to 0.7%.

#### ● Wine

The acid level of wine is adjusted (increased or decreased) through a manufacturing process called "acidification." In this process, the acid level of a wine is increased by adding various organic acids. The acid level is decreased by adding water or fruit juice. Consequently, this means the acid level is monitored closely and measured frequently.

The **PAL-Easy ACID2** and **PAL-BX|ACID2** are easy to carry,

which makes them immensely convenient and useful for quick and easy on-site measurements.

In some parts of the world (such as France), the acid level of wine is expressed using a sulfuric acid conversion. In some cases, acid level may also refer to "pH" or to "the volume of alkaline solution in acid-base titration."

Wine contains various types of acid, but the predominant acids are tartaric and malic. The acid level is obtained through a conversion from total acidity to tartaric acid.

The acid level of wine ranges from about 0.4 to 1.0%.

#### Acid Level of Grapes & Wine (Rough Guide)

Grapes (Pione)	0.60%
Grapes (Delaware)	0.59%
Grapes (Kyoho)	0.47%
Grape juice	0.28 to 0.54%
Red wine	0.49 to 0.65%
White wine	0.50 to 0.73%

**Recommended Products**

Grapes & Wine (Brix-Acidity) <b>PAL-BX ACID2</b> Cat.No.7102	Grapes & Wine (Acidity) <b>PAL-Easy ACID2</b> Cat.No.7302	Multi Fruits (Brix-Acidity) <b>PAL-BX ACID F5</b> Cat.No.7100	Multi Fruits (Acidity) <b>PAL-Easy ACID F5</b> Cat.No.7300
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**Tomatoes have a strong sour taste. When preparing a meal, adding just a tiny bit of sugar will diminish the acidity and balance out the flavor!**

**In general, strawberries have high sugar levels and low acid levels.**

## Tomatoes

Recently, improvements made to tomato species have led to tomatoes with high sugar levels. At the same time, acidity is also starting to garner attention.

The **PAL-Easy ACID3** and **PAL-BX|ACID3** can quickly and easily measure acid level. The **PAL-BX|ACID3** allows for both acid level and sugar level measurement with a single unit, making it extraordinarily convenient and useful.

The acid in tomatoes is comprised of citric and malic acid. The ratio (percentage) of these two acids varies depending on the type of tomato and the cultivation process. The acid level is obtained through conversion from total acidity to citric acid.

When preparing a sample for measurement, filtering freshly squeezed tomato juice through a sieve or coffee filter will yield more stable results.

The acid level of tomatoes ranges from about 0.3 to 0.8%.



Recently, there are many varieties of really sweet tomatoes.

### Acid Level of Common Tomatoes (Rough Guide)

- Tomatoes .....0.39%
- Mini tomatoes.....0.45%
- Amela tomatoes (a type of high sugar level tomato developed in Shizuoka, Japan) .....0.80%

**Recommended Products**

Tomatoes (Brix-Acidity) <b>PAL-BX ACID3</b> Cat.No.7103	Tomatoes (Acidity) <b>PAL-Easy ACID3</b> Cat.No.7303	Multi Fruits (Brix-Acidity) <b>PAL-BX ACID F5</b> Cat.No.7100	Multi Fruits (Acidity) <b>PAL-Easy ACID F5</b> Cat.No.7300
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## Strawberries

Strawberries are a perennial plant belonging to the rose (Rosaceae) family. At first glance, a strawberry certainly resembles a fruit, but it isn't really a fruit at all. The part that resembles a fruit is called the "torus," or "receptacle," and it's actually an enlarged, fleshy part of the plants stalk. In fact, the very small, hard seeds on the outside of the strawberry are the real fruits! During the latter half of cultivation, sugar levels decrease, leading to an increase in sourness. This results in a deterioration in flavor.

There are many different varieties of strawberries. Most recently, there are strawberries ranging from pure white to exceedingly, deep, dark "black". Strawberries can mainly be picked from winter through early summer. Strawberries are rich in vitamin C so eating just 5 or 6 is enough to meet your daily requirement (100mg)! Strawberries also contain a kind of polyphenol called anthocyanin, which acts as a powerful antioxidant. Strawberries are a fantastic fruit for maintaining health and beauty.

Sugar level and acid level are the most crucial points when evaluating strawberries. Strawberries range in sugar

level (Brix) between 8 to 10% while acid levels range from 0.7 to 1.0%. It is not easy to measure a strawberry's acid level with titration, however. Due to the strawberry's pigmentation, measurements with acid-base titration requires a skilled, experienced analyst. This method is also rather time-consuming.

The **PAL-Easy ACID4** and **PAL-BX|ACID4** can quickly and easily measure acid level.

When buying strawberries, general consumers consider these key points: freshness, flavor, color, and size.

### Acid Level of Strawberries (Rough Guide)

- Amaou (type of strawberry developed in Fukuoka, Japan) .....0.95%
- Tochtome (type of strawberry developed in Tochigi, Japan) .....0.71%
- Sachinoka (type of strawberry developed in Nagasaki, Japan) .....0.87%

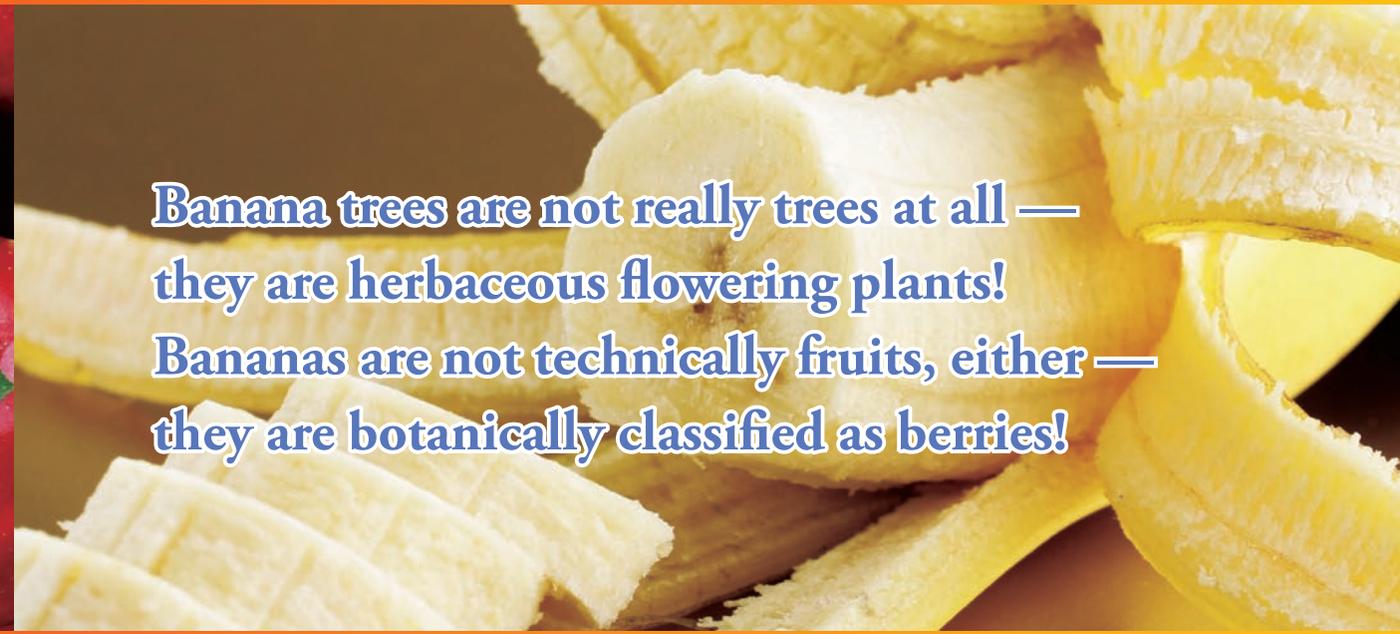
**Recommended Products**

Strawberries (Brix-Acidity) <b>PAL-BX ACID4</b> Cat.No.7104	Strawberries (Acidity) <b>PAL-Easy ACID4</b> Cat.No.7304	Multi Fruits (Brix-Acidity) <b>PAL-BX ACID F5</b> Cat.No.7100	Multi Fruits (Acidity) <b>PAL-Easy ACID F5</b> Cat.No.7300
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**An apple a day keeps the doctor away**



**Banana trees are not really trees at all — they are herbaceous flowering plants! Bananas are not technically fruits, either — they are botanically classified as berries!**

## Apples

For most people, apples would be the first thing that comes to mind when they hear the word "fruit."

There are approximately 15,000 varieties of apples in the world—Japan alone has 2,000 varieties. The prime season for apples is from autumn to winter.

"Pruning" and "thinning" are indispensable practices for producing large, good quality apples. Apple blossoms grow and bloom closely together in clusters. The largest, central blossom is left intact, while the smaller surrounding blossoms are pruned away from the branch. As the apple tree continues to grow, the pruned branch may produce several young apples. Only the most well-shaped and hardest young apples with the thickest stems are left on the tree, while the rest of the young apples are removed.

An apple's color is largely influenced by sunlight. Apples are rotated to ensure they are bathed in sunshine, while leaves are pruned away.

The apples that finally reach consumers are the very highest quality as they have been hand selected after passing the stringent and rigorous harvesting process.

Apples contain many substances such as malic and citric acid, potassium, pectin (a kind of dietary fiber), and polyphenols, which are well-known as a potent antioxidants. The apple is truly a remarkable fruit that we can count on to help promote our health and beauty.

The majority of apples have a wide sugar level, ranging from about 12% to 17%. Their acid level is about 0.2 to 0.3%, which is quite low among fruits.

**Recommended Products**

Apples (Brix-Acidity)	Apples (Acidity)
<b>PAL-BXIACID5</b>	<b>PAL-Easy ACID5</b>
Cat.No.7105	Cat.No.7305



For further product details [P.B13](#) For further product details [P.B13](#)

**Acid Level of Apples (Rough Guide)**

- Wase Fuji (type of apple developed in Aomori, Japan) ···0.27%
- Senshuu (type of apple developed in Aomori, Japan)····0.32%

## Bananas

Bananas are a tremendously important fruit in our everyday diet; over 1.3 hundred million tons of bananas are consumed worldwide in a single year!

Bananas are largely divided into two categories: soft, sweet bananas (dessert bananas) that are eaten as is, and firmer, starchier bananas (plantains) that are primarily used for cooking. There are over 300 varieties of bananas in the world.

Bananas are native to tropical and sub-tropical regions. The region that lies 30° North and 30° South of the equator, where bananas are cultivated, is known as the "banana belt."

Bananas contain an abundance of B vitamins, which promote radiant health and beauty. The long, thin strands that are found under the peel (and which many people toss aside) are called "phloem" and are rich in polyphenols. Bananas are surprisingly low in calories and are also a plentiful source of potassium, which helps alleviate swelling. Additionally, bananas can be readily eaten by hand, making them a great choice for breakfast.

Bananas have the highest sugar levels among all the fruits; mainly around 19% to 25% . They have significantly low acid levels at about 0.1 to 0.3% .

**Recommended Products**

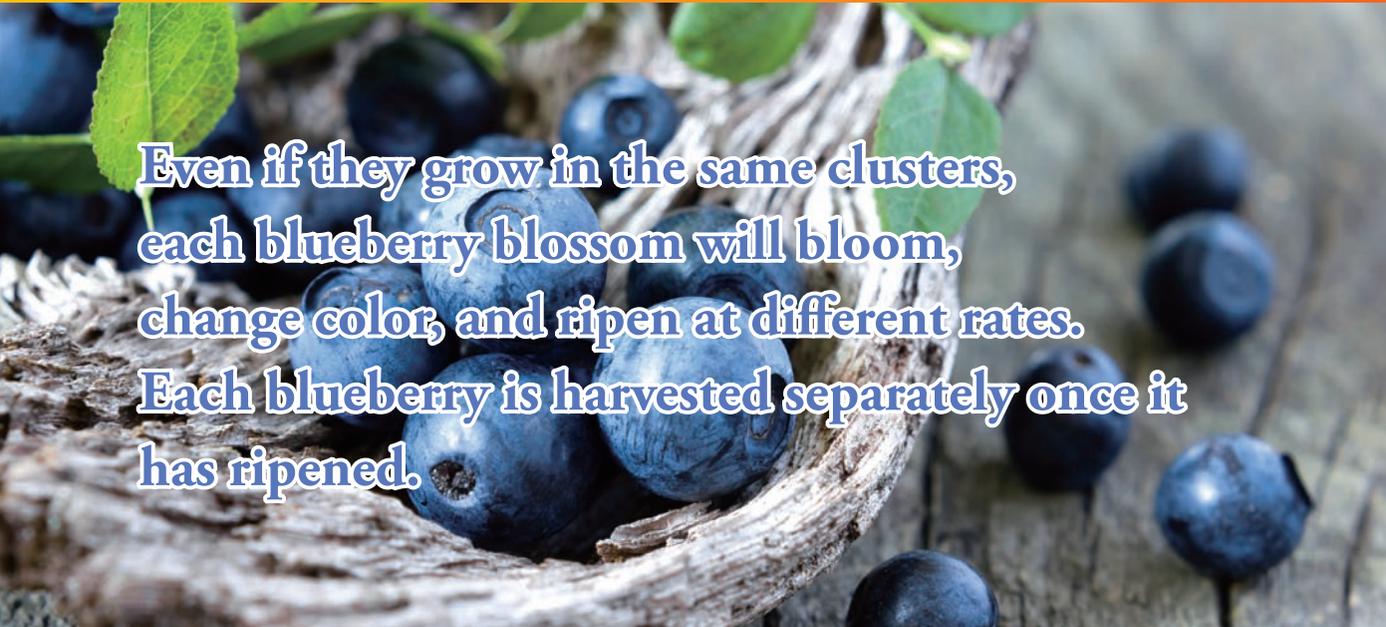
Bananas (Brix-Acidity)	Bananas (Acidity)
<b>PAL-BXIACID6</b>	<b>PAL-Easy ACID6</b>
Cat.No.7106	Cat.No.7306



For further product details [P.B14](#) For further product details [P.B14](#)

**Acid Level of Bananas (Rough Guide)**

- Bananas ···········0.18 to 0.26%



Even if they grow in the same clusters, each blueberry blossom will bloom, change color, and ripen at different rates. Each blueberry is harvested separately once it has ripened.

## Blueberries

Blueberries are comparatively low shrubs, with heights ranging from 1.5m to 3m. After their small, white, bell-shaped flowers bloom, they produce indigo colored berries starting in spring and continuing through summer.

Blueberries are categorized into 6 types, but the 3 most commonly eaten types are: high-bush blueberries, rabbiteye blueberries, and low-bush blueberries.

When cultivating blueberries, it is much more beneficial to cross-pollinate one type of blueberry with a different type. Cross-pollination results in an increased fruition rate, higher yields, and larger berries. It is common to cultivate different types of blueberries together, collectively harvest them, pack them together (unsorted), and ship them out.

Blueberries tend to thrive best in well-drained, acidic soil.

Aside from being sold as-is and ready to eat, there are also a number of manufactured products made from blueberries such as jams, purees, and juices.

Blueberries are known for their numerous health benefits, particularly for improving vision and overall health and beauty. This is because blueberries contain an abundance of anthocyanins, which are powerful antioxidants.

The sugar levels of blueberries ranges from about 9% to 13% , and their acid levels tend to range widely from about 0.4% to 1.2% .

### Acid Levels of Blueberries (Rough Guide)

- Chilean blueberries ..... 0.47 to 0.63%
- Mexican blueberries ..... 1.14%

**Recommended Products**

Blueberries (Brix-Acidity) <b>PAL-BXIACID7</b> Cat.No.7107	Blueberries (Acidity) <b>PAL-Easy ACID7</b> Cat.No.7307	Multi Fruits (Brix-Acidity) <b>PAL-BXIACID F5</b> Cat.No.7100	Multi Fruits (Acidity) <b>PAL-Easy ACID F5</b> Cat.No.7300
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Kiwi is the symbol of New Zealand. The fruit was named after the Kiwi (flightless birds native to New Zealand).

## Kiwi

Kiwi cultivation is comparatively easy. It is a climbing vine, so if the vines are properly trailed across a supporting structure, such as a trellis, and both male and female plants are cultivated, fruit can be harvested from October to November. Although it's possible for 1 kiwi vine to produce about 1000 pieces of fruit, it is far more effective and beneficial to utilize artificial pollination and thinning methods.

These practices prevent sugar levels from decreasing and acid levels from increasing, which results in an improved flavor overall.

Kiwi will not ripen while on the vine. Freshly harvested kiwi are hard, sour, and not very tasty.

Once it is harvested, placing kiwi with other fruits that emit ethylene gas, such as apples, allows the kiwi to fully ripen and become delightfully flavorful.

Kiwi contains a high amount of vitamin C. This amount is nearly equivalent to the amount of vitamin C found in persimmons, which ranks 4th, preceded by acerola, guava, and lemon. Kiwi is peculiar among fruits in that it contains chlorophyll.

Chlorophyll has several beneficial effects: it has a detoxifying effect and promotes gastro-intestinal health, prevents cancer and anemia, and is also thought to lower cholesterol.

The sugar level (Brix) of kiwi is roughly 10 to 16% , while kiwi with acid levels of 1.1 to 1.6% are cropping up.

**Recommended Products**

Kiwi (Brix-Acidity) <b>PAL-BXIACID8</b> Cat.No.7108	Kiwi (Acidity) <b>PAL-Easy ACID8</b> Cat.No.7308
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For further product details [P.B15](#) For further product details [P.B15](#)

### Acid Levels of Kiwi (Rough Guide)

- New Zealand green kiwi ..... 1.55%
- American gold kiwi ..... 1.17%

**Pineapples do not ripen any further once harvested.**  
**Pineapples are harvested after they're fully ripened. This means fresh-picked pineapples are the best tasting!**

**Plums are known in Japan as 'Sumomo' or 'Sour Peaches'.**

## Pineapples

Once a seed is planted, a pineapple requires a long cultivation period (4 to 5 years) until it is mature enough to produce fruit. Since pineapples are perennials (a plant that lives for more than two years), the plant will continue to produce fruit even after it is first harvested. After the initial harvest, however, the fruits become smaller. Thus, it is quite rare for a pineapple plant to produce enough fruit for more than 3 harvests.

How do pineapples develop? If you have never seen a pineapple growing in person, you may think that pineapples grow and hang from trees. But this isn't the case at all. Pineapples grow out of the ground! A stem and long leaves emerge from the soil. Several leaves grow upward from the center and the fruit grows out of the central stem.

Aside from sugar, pineapples contain many other substances such as citric and malic acid, calcium, potassium, vitamin C, vitamin B, and enzymes. The enzyme found in pineapple juice is called "bromelain." Bromelain plays an important role in breaking down proteins and aiding digestion.

However, the protein dissolving properties of bromelain means that fresh pineapples can't be used to make gelatin desserts. The gelatin (which contains protein) will never set!

Pineapples that aren't fully ripe contain a particularly large amount of acids and bromelain. Due to their aforementioned effects on proteins, if you took a bite of unripe pineapple, it may cause damage to your mouth and tongue. A fully ripened pineapple contains much less bromelain, though if you eat a lot of pineapple at once, the inside of your mouth will begin to hurt a bit-undoubtedly something that many of us have experienced before. The amount of bromelain in a pineapple can be reduced by keeping it stored for a while or leaving it out for a bit after cutting and slicing it. This will decrease the amount of bromelain, but may also affect the freshness.

The sugar level (Brix) of pineapples is about 13 to 15% .  
 The acid level is about 0.6 to 0.7% .

**Recommended Products**

Pineapples (Brix-Acidity)		Pineapples (Acidity)	
<b>PAL-BXIACID9</b>		<b>PAL-Easy ACID9</b>	
Cat.No.7109		Cat.No.7309	

For further product details [P.B15](#) For further product details [P.B15](#)

**Acid Level of Pineapples (Rough Guide)**

- Pineapples ..... 0.62 to 0.66%

## Plum

The Japanese Plum has a long history; said to have originated in China and come to Japan in the Yayoi Period (300BCE - 250CE). While large-scale farming is began during the Taisho Period (1912 - 1926), the fruit crossed the Pacific Ocean in the 19th Century to California.

Meanwhile, the so called Western Plum originated in the Caucasus Region, on the Caspian Sea, and has been farmed in Europe since ancient times . The plum crossed the Atlantic Ocean on the Great Voyage and was being mass-produced in California by the 19th Century.

It was in California that the Japanese and Western Plum were cross-bred and the results spread throughout the world. New varieties came back to Japan including the Soldum, Santa Rosa, and Beauty. In modern times, alterations to the acidity and size are creating many new varieties.

The small and unassuming plum contains malic acid for combating fatigue, folic acid and other vitamins vital for blood cell creation and fetal development, vitamin E which protects the body against active oxygen, potassium which helps combat nutrient deficiencies - they are simply bursting with vitamins and minerals. Through the plums long history it has developed a well-deserved reputation as a nutritious food all over the world.

Plums typically have a Brix value of 14 to 17% and a relatively high acid value of 0.4 to 1.5%.

**Recommended Products**

Plum (Brix-Acidity)		Plum (Acidity)	
<b>PAL-BXIACID11</b>		<b>PAL-Easy ACID11</b>	
Cat.No.7111		Cat.No.7311	

For further product details [P.B16](#) For further product details [P.B16](#)

**Acid Levels of Plum (Rough Guide)**

- Plum ..... 0.4 to 1.55%

Acidity becomes stronger toward the center.  
Turning over the Kanji (Chinese characters) for 'Middle acid' gives us the origin for the 'Nashi'.

Pears require ripening  
If a pear is soft when gently pressed around its circumference, it is ready to eat.

## Nashi Pears (Asian Pear)

Nashi are divided into 'akanashi' (Russet pears) and 'aonashi' (Green pears).

The akanashi, including types like 'Hosui' and 'Kosui', have a brown skin, while the aonashi, which includes the 'Nijisseiki' type, have green skin.

Both exhibit the same distinct crisp texture that is found in nashi pears. This comes down to what is known as 'stone cells', where pentosan and lignin has built up in the flesh of the fruit, making the cell walls thick and hard like stone. These substances aren't digested and have an effect similar to dietary fiber in that they aid bowel activity by stimulating the intestines. This is also found in western pears, though to a much lesser extent, and thus texture is the main difference between the two.

Another difference between nashi and pears is that nashi are do not require ripening so once mature enough the nashi are harvest and immediately shipped.

Pears are said to have anti-inflammatory effects in Chinese medicine.

Aspartic acid, an amino acid found in nashi pears, is an effective diuretic.

They also contain sorbitol, a sugar alcohol, is said to stop coughs and reduce fever.

Tannin, a type of polyphenols, has the effect of encouraging alcohol discharge from the body, so combined with the high water content and potassium levels, it is thought that nashi are effective at reducing the effects of hangovers.

Asian pears typically have a Brix value of 12 to 14% and an acid value of 0.06 to 0.4%.

**Recommended Products**

Nashi Pears (Brix-Acidity)	Nashi Pears (Acidity)
<b>PAL-BXIACID12</b>	<b>PAL-Easy ACID12</b>
Cat.No.7112	Cat.No.7312

For further product details [P.B16](#) For further product details [P.B16](#)

**Acid Level of Nashi Pears (Rough Guide)**

- Kosui ..... 0.06 to 0.10%
- All other varieties ..... 0.10 to 0.40%

## Pear

The pear is known as 'The most beautiful fruit in the world' in Europe, with its shape said to resemble 'the breasts of a goddess' and its aromatic juice called 'the tears of Venus'. In comparison to nashi pears, with their crisp, sharp texture, western pears are sweet and fragrant and have a smooth texture.

At the time of harvest, pears are starchy, not sweet and hard to the touch. Before pears are edible, they must be ripened through storage at a constant temperature. Through the ripening process, the starch becomes fructose, sucrose, and glucose, the levels of vitamin B and C increase and the pear because a sweet and juicy treat. The season for pears is from Fall to Winter. Popular types of pear found in stores include the Claude Blanchet, Le Conte, the Bartlett, and the Aurora.

Pears are ideal for breakfast because they contain vitamins A, B, C, E, folic acid, dietary fiber, potassium, salt, sugar, iodine, iron, calcium - they are packed with nutrients suitable for starting the day. Additionally, the tannins and caffeic acid contained in pears give an antibacterial benefit, helping to protect you from diseases and infections. Pears also contain polyphenols such as banol and anthocyanin, which are though to possibly aid in preventing cancer and they have an abundance of vitamin C.

Pears typically have a Brix value of 13 to 14.5% and an acid value of 0.3 to 0.4%.

**Recommended Products**

Pear (Brix-Acidity)	Pear (Acidity)
<b>PAL-BXIACID14</b>	<b>PAL-Easy ACID14</b>
Cat.No.7114	Cat.No.7314

For further product details [P.B17](#) For further product details [P.B17](#)

**Acid Level of Pear (Rough Guide)**

- Bartlett ..... 0.35 to 0.50%
- General Leclerc ..... 0.35 to 0.45%
- La France ..... 0.20 to 0.30%
- Aurora ..... 0.10 to 0.20%

Coffee trees only grow below the Equator in the area surrounding the Tropic of Capricorn (25° North and South latitude).

In Japan, the acid level of vinegar is determined by the Japanese Agricultural Standards (JAS).

## Coffee Cherries

Small, white flowers bloom on coffee trees. These charming little white flowers have a fragrance reminiscent of Jasmine. It is said that it is difficult to catch a glimpse of these tiny blossoms because they fall from the trees after a mere 2 days. After the blossoms drop, green fruits emerge. As the fruits grow, they become red.

These fruits are called "coffee cherries," because of their similar appearance to cherries. Coffee cherries normally contain 2 coffee beans (with the smooth, flat sides of the beans resting against each other). Occasionally, a coffee cherry will contain only 1 coffee bean, or sometimes even 3 coffee beans. When a coffee cherry only contains a single coffee bean, the coffee bean is called a "peaberry." Green coffee beans that have been removed from the coffee cherry undergo a process that transforms their physical and chemical properties to produce the characteristic flavor of coffee.

This process is called "roasting." It is at this stage that the coffee beans finally acquire their characteristic roasted, brown color. Most everyone is familiar with coffee in this form, but rarely have they seen green coffee or coffee cherries.

The flesh (pulp) of the coffee cherry is exceedingly sweet and edible, but the small amount of flesh produced will spoil quickly.

For these reasons, coffee cherries have not really appeared in retail markets. However, in recent years it has finally become easier to obtain processed coffee cherry products such as dried or powdered coffee cherries.

Coffee cherries contain only a slight amount of caffeine. The caffeic acid within coffee cherries prevents cancer and atherosclerosis (hardening of the arteries). The chlorogenic acid guards against diseases such as diabetes or fatty liver.

The flavor and fragrance of coffee cherries is utterly different from coffee. Coffee cherries are used to make jam, due to their intense sweetness.

The Brix and acid level of coffee cherries ranges widely between 6.5% to 29% and 0.3 to 0.9% respectively.



**Recommended Products**

Coffee Cherries (Brix-Acidity)	Coffee Cherries (Acidity)
<b>PAL-BXIACID40</b>	<b>PAL-Easy ACID40</b>
Cat.No.7140	Cat.No.7340

For further product details [P.B17](#) For further product details [P.B17](#)

**Acid Levels of Coffee Cherries (Rough Guide)**

- Okinawan coffee cherries.....0.67%
- Indonesian coffee cherries .....0.57%

## Vinegar

Vinegar is a sour substance produced by the fermentation of alcohol.

Just as there are many varieties of alcohol in the world, there are all kinds of vinegars produced by fermenting the different varieties of these alcohols. For example, in Japan, rice vinegar is made from sake which is a traditional Japanese alcohol made from rice; in England and Germany, malt vinegar is made from beer; in America, apple cider vinegar is made from apple cider.

Along with salt and spices, vinegar is used as a seasoning in various fish and meat dishes, as well as a preservative for foods such as pickles. Vinegar isn't the only thing used for its acidity in cuisine; fruit juices with a sharp, sour flavor such as lemons, sudachi (a small, round, green, Japanese citrus fruit), and kabosu (another type of Japanese citrus fruit) are also used for culinary purposes.

Vinegar contains various kinds of acids, but the predominant acid is acetic acid. The acid level is determined by total acidity to acetic acid conversion.

The acid level is most often measured using an acid-base titration system, as written in the regulations stipulated by JAS. Although the general measurement principles differ from titration, the acid level of vinegar can be measured with the **PAL-Easy ACID181** or **PAL-BX|ACID181**.

These units are easy to carry, allowing for convenient on-site measurements.

**The Important Culinary Role of Vinegar**

- Imparts acidity and increases savory qualities
- Adds fragrance
- Improves shelf-life
- Coagulates proteins
- Balances out the degree of acidity
- Mellows salty flavors
- Brings out and brightens the color of foods
- Preserves the color of foods
- Promotes gelling

(Excerpt from Nippon Suisan Kaisha's [a Japanese marine products company] A Scientific Study of Tastiness)

**Recommended Products**

Vinegar (Brix-Acidity)	Vinegar (Acidity)
<b>PAL-BXIACID181</b>	<b>PAL-Easy ACID181</b>
Cat.No.7581	Cat.No.7781

For further product details [P.B20](#) For further product details [P.B20](#)

**Acid Levels of Vinegar (Rough Guide)**

- Grain vinegar..... 1.98%
- Apple cider vinegar..... 1.26%
- Rice vinegar ..... 1.15%
- Wine vinegar ..... 1.21%

Cows are marked by a distinctive symbol burned into the animal's skin with a hot branding iron. This is done to indicate ownership and differentiate one person's cow from another's. This practice, known as branding, is the origin for the term "brand," meaning any symbol, name, or other feature that distinguishes one product from another.

One important role of acid is its coagulative effect on proteins. This is how yogurt is made!

## Milk

Raw milk comes from cows.

Fresh milk is an essential ingredient for various types of processed products and foods. Dairy products that are ordinarily eaten on a daily basis include milk, yogurt, cheese, butter, fresh cream, and ice cream. Additionally, milk is also the primary ingredient in whey protein, which is indispensable to body-builders and athletes for strengthening their muscles and general physique.

The organic acid primarily found in milk is lactic acid. By measuring the milk's acid level, its degree of freshness can be determined. Milk degrades rapidly and is sensitive to heat, which means acid level measurements are an absolute necessity. As the degree of freshness decreases, the lactic acid increases.

Milk contains an ideal balance of protein and calcium.

Milk can be consumed as-is, but it is often added to coffee or tea. Milk is also used in many types of cuisine and alcoholic beverages. Milk is truly an integral part of our diet.

The Brix level of milk is roughly around 11 to 14% . The acid level is about 0.1% .

## Yogurt

Typical foods that contain lactobacillus are yogurt, yogurt-based drinks, and probiotic beverages (probiotic dairy products made by fermenting a mixture of milk with lactobacillus).

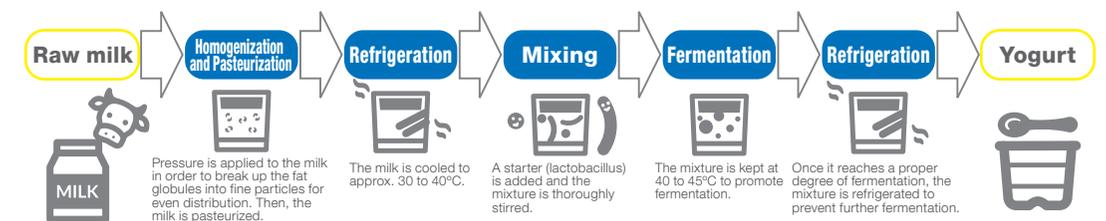
The manufacturing process varies depending on the kind of yogurt. Below is an example of the manufacturing process for plain yogurt.

Yogurt is made from milk and a strain of lactobacillus bacteria referred to as a "starter" (yogurt culture). Some strains of lactobacillus used are Lactobacillus bulgaricus, Streptococcus thermophilus, and Lactobacillus acidophilus.

First, raw milk is pasteurized (heat-sterilized) and refrigerated. Once the milk is cooled, lactobacillus are added to the milk, and the mixture is

thoroughly stirred. The yogurt is then stored in a temperature controlled room called a "fermentation chamber." This facilitates fermentation of the yogurt. The most suitable temperature to promote fermentation differs depending on the kind of lactobacillus, but in general, the yogurt is stored at approx. 40°C for 4 to 6 hours. This allows the yogurt to ferment, which causes an increase in lactobacillus and acid level. Monitoring the acid level is extremely critical at this stage. In general, the acid level is set around 0.7 to 0.8%. Once the increase in acid level is confirmed, the yogurt is refrigerated. During refrigeration, the acid level increases slightly. This manufacturing process ensures that the yogurt's final acid level is about 0.9 to 1.0%; just right and ready to eat!

The Brix level of yogurt will vary depending on the yogurt, but it's generally from 7.5 to 16%. The acid level is approx. 0.6 to 1.0%.



**Recommended Products**

Milk (Brix-Acidity)	Milk (Acidity)
<b>PAL-BXIACID91</b>	<b>PAL-Easy ACID91</b>
Cat.No.7191	Cat.No.7391

For further product details [P.B18](#) For further product details [P.B18](#)

**Acid Level of Milk (Rough Guide)**

· Milk	0.1%
--------	------

**Recommended Products**

Yogurt (Brix-Acidity)	Yogurt (Acidity)
<b>PAL-BXIACID96</b>	<b>PAL-Easy ACID96</b>
Cat.No.7196	Cat.No.7396

For further product details [P.B18](#) For further product details [P.B18](#)

**Acid Levels of Yogurt (Rough Guide)**

· Yogurt	0.9 to 1.0%
· Yogurt drink	0.52%
· Probiotic beverage A	0.55%
· Probiotic beverage B	0.41%

The Japanese kanji (characters) for "beer" is "麦酒 (bakushu)."

The acid level of sake from lowest to highest:  
 tanrei amakuchi (light and mellow sake) → tanrei karakuchi (crisp and dry sake with moderate sourness and sweetness) → noujun amakuchi (full-bodied and mellow sake with strong sourness and sweetness) → noujun karakuchi (full-bodied and sharp sake with very strong sourness and sweetness)

## Beer

It is said that the origin of beer dates back to over 4000 BC.

There are many kinds of beer, such as ale, which has been consumed since ancient times, and lager, which has a characteristically bitter hop flavor and strong effervescence. Lager is the most mainstream style of beer in Japan.

Beer is a type of alcoholic beverage made from malted barley. Other ingredients include water, starch derived from malted barley, yeast, and flavorings. Hops, corn, rice, various sugars, and potatoes are also used in place of malted barley. In Japan, beer has a set definition and any beverage with ingredients, like corn or rice, that make up more than half of the components (not including malted barley) is not considered beer.

These types of beverages are called, Happoshu (a category of Japanese liquor that is a beer-like beverage with less than 67% malt content).

The main component of beer is water. Water quality and mineral content varies by region, so the unique distinctiveness of a region shines through in its beer. For example, Ireland's high-mineral content (hard) water imparts flavor to Guinness (an Irish dry stout that originated in Dublin) and other stout beers, and the water from Bourton in England is ideal for making pale ales.

The acid level of dark beers, such as stouts, is difficult to measure with acid-base titration. The dark, deep color of the beer interferes with the indicator (reagent), so the neutralization point is obscured and unclear. The **PAL-Easy ACID101** and **PAL-BX|ACID101** features a completely digital display, so the total acidity can be read easily and clearly by anyone.

The Brix of beer ranges from 4.5% to 14.5% and the acid level ranges from 1.3 to 2.2% .

**Recommended Products**

<p>Beer (Brix-Acidity) <b>PAL-BX ACID101</b> Cat.No.7501</p> 	<p>Beer (Acidity) <b>PAL-Easy ACID101</b> Cat.No.7701</p> 
For further product details <a href="#">P.B19</a>	For further product details <a href="#">P.B19</a>

**Acid Level of Beer (Rough Guide)**

· Beer .....	1.47 to 3.65%
--------------	---------------

## Sake (traditional Japanese alcohol)

The acid found in sake is made up of lactic, succinic, citric, and malic acid. The acid level is determined by adding up all of these acids.

Kuramoto (sake producers) in Japan strive toward further improving the quality of sake through research. In addition to flavor, "umami" (savoriness), sweetness, and dryness, acid level is also a critical factor of nihonshu-do (sake meter value [SMV]). SMV is calculated from the specific gravity of the sake and indicates the sugar and alcohol content of the sake on an arbitrary scale.

There is a method for measuring the acid level of sake as written and prescribed by the National Tax Administration's Designated Analysis Law of Japan.

The **PAL-Easy ACID121** and **PAL-BX|ACID121** can measure and display the same acid level values, though their general measurement principles differ from the method described in the Designated Analysis Law. These units are easy to transport and carry, allowing for convenient on-site measurements.



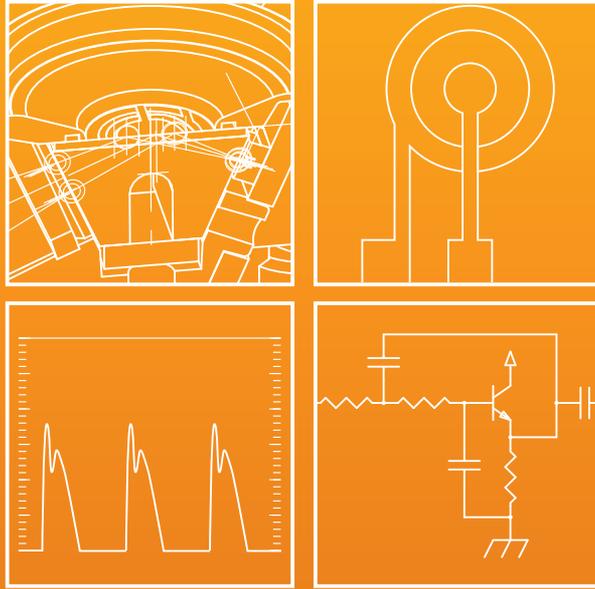
Well-chilled sake on a hot summer day.

**Recommended Products**

<p>Sake (Brix-Acidity) <b>PAL-BX ACID121</b> Cat.No.7521</p> 	<p>Sake (Acidity) <b>PAL-Easy ACID121</b> Cat.No.7721</p> 
For further product details <a href="#">P.B19</a>	For further product details <a href="#">P.B19</a>

**Acid Levels of Sake (Rough Guide)**

· Sake A (Niigata, Japan).....	1.36%
· Sake B-regular sake (Akita, Japan) .....	1.07%
· Sake C-junmai sake (sake made without added alcohol or sugar) (Akita, Japan) .....	1.51%
· Sake D (Toyama, Japan) .....	1.04%
· Sake E (Hyogo, Japan) .....	1.10%
· Sake F (Hokkaido, Japan) .....	1.20%
· Sake G (Niigata, Japan) .....	1.20%
· Sake H (Niigata, Japan) .....	1.14%



# Acidity Meter Guide

To users measuring acid level with  
acid-base titration (neutralization)

# What is “Acid Level?”

Imagine drinking some lemon juice or vinegar, or eating "Umeboshi (Japanese pickled plum)."

What flavor comes to mind?

All these foods share a common trait: "sour!" This is because they contain acid.

Generally when we eat, not much thought is given to acidity.

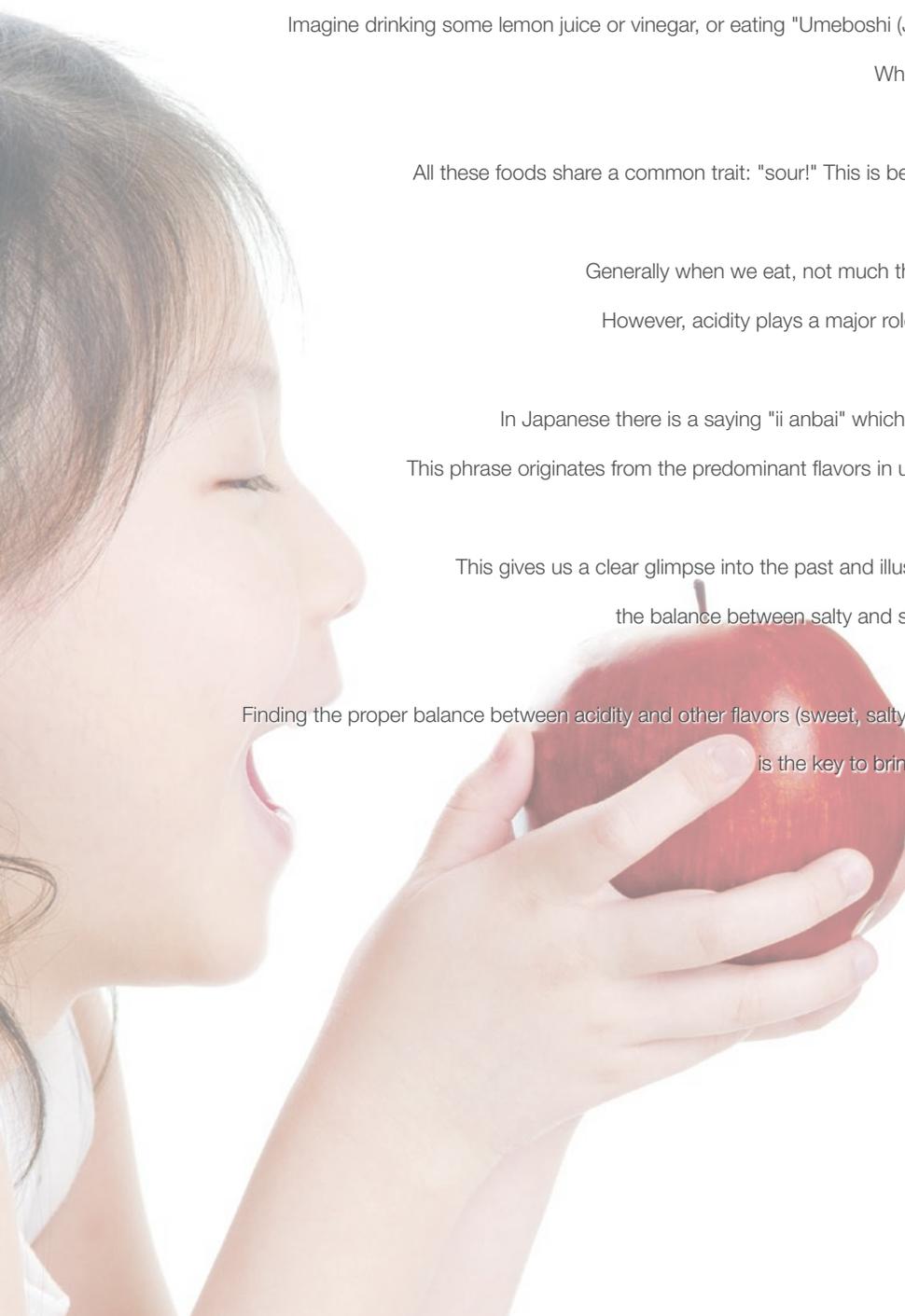
However, acidity plays a major role among the five senses.

In Japanese there is a saying "ii anbai" which means "well-seasoned."

This phrase originates from the predominant flavors in umeboshi; salty and sour.

This gives us a clear glimpse into the past and illustrates the importance of the balance between salty and sour in determining flavor.

Finding the proper balance between acidity and other flavors (sweet, salty, bitter, "umami" [savory]) is the key to bringing out "deliciousness."



All ATAGO products are designed and manufactured in Japan.

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**HACCP GMP GLP**  
ATAGO products comply with HACCP, GMP, and GLP system standards.

- |   |                                |                                    |
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# Acid Level and Flavor

## ● Sugar Level & Acid Level of Fruit

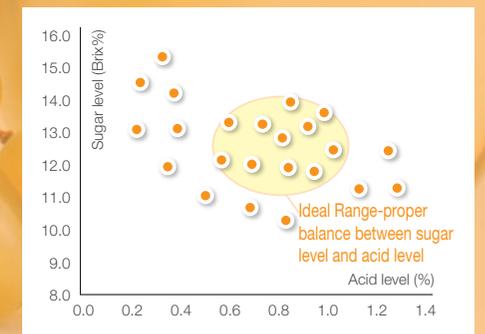
Phrases often used to promote the sale of fruit include "sweet" or "high nutrient content (sugar level)". It is doubtful that "sour" or "high acid levels" would be an effective sales pitch for fruits. Nevertheless, acid, in addition to sugar, is a crucial element in producing the marked increase in flavor you detect when biting into a high quality piece of fruit.

Naturally, no one likes fruit that is too sour or that has a high acid ratio. A truly delectable fruit is one which contains the proper balance between sweet and sour (rather than a fruit that is simply just sweet). In other words, the fruit contains the proper sugar acid ratio (Brix-Acid ratio).

Lemons and strawberries have a very similar sugar level (Brix). Even though they share a similar Brix, the acid level of lemons is incredibly high. The high level of acid prevents us from detecting the sweetness.

High acid levels lead to difficulties in detecting sweetness. Acid levels that are too low result in bland, weak flavors.

Citrus fruits, like "mikan (oranges)" are closely monitored after being harvested to determine the perfect time to ship them out. Once harvested, oranges are kept in a storage facility. This promotes an increase in the sugar levels and a decrease in the acid levels. Oranges are held in storage until they reach the proper sugar and acid balance. A tasty orange will have a sugar level between 11.0 to 14.0% and an acid level between 0.5 to 1.0% .



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# What Are the Differences Between Acid Level and pH?

"Acid level" illustrates the percentage of acid contained within a solution and is an indicator of sourness (acidity). For more details on acid level measurement methods, refer to pg. B21.

In Japan, acid levels are generally expressed in terms of how many grams of acid are contained in 100mL of a solution (%). In other countries, acid levels are expressed in a variety of ways, such as how many grams of acid are contained within 1000mL (1L) of a solution.

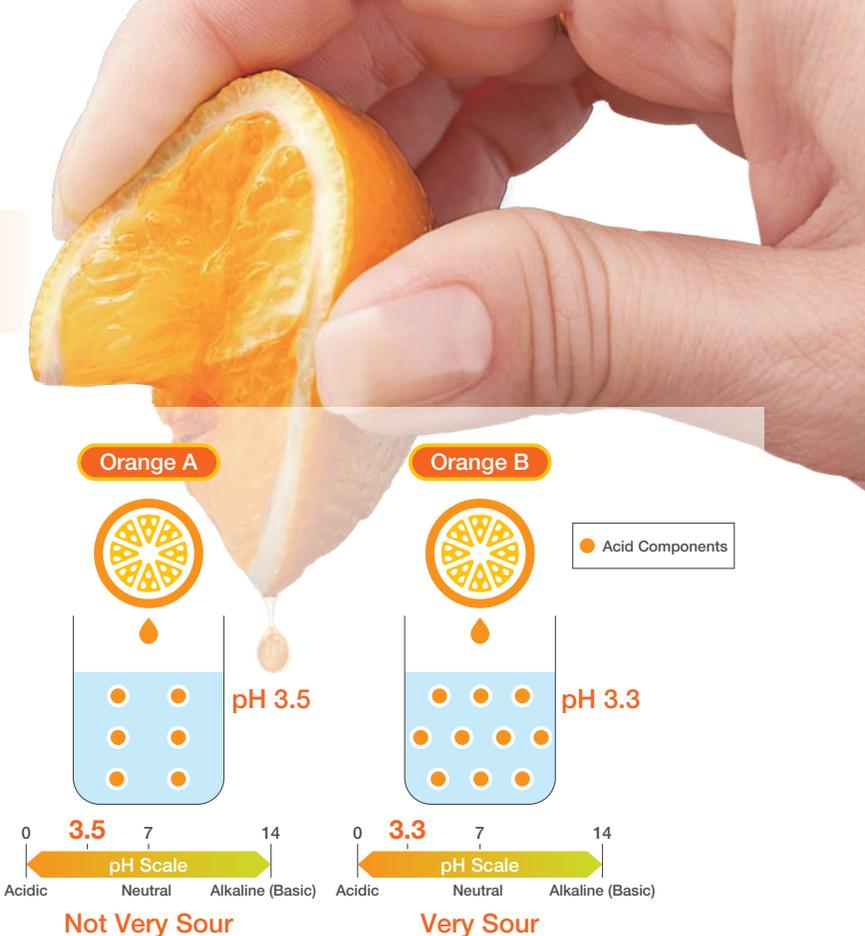
Aside from acid level, pH is also used to express the degree of acidity. Many of us will recall using

litmus paper in school to measure pH in various experiments. pH can tell us the degree of acidity in a solution and thereby determine whether that solution is acidic, alkaline (basic), or neutral.

There is a relationship between pH and acid level, but their basic principles are different. pH is an expression of the hydrogen ions (H+) concentration within a solution.

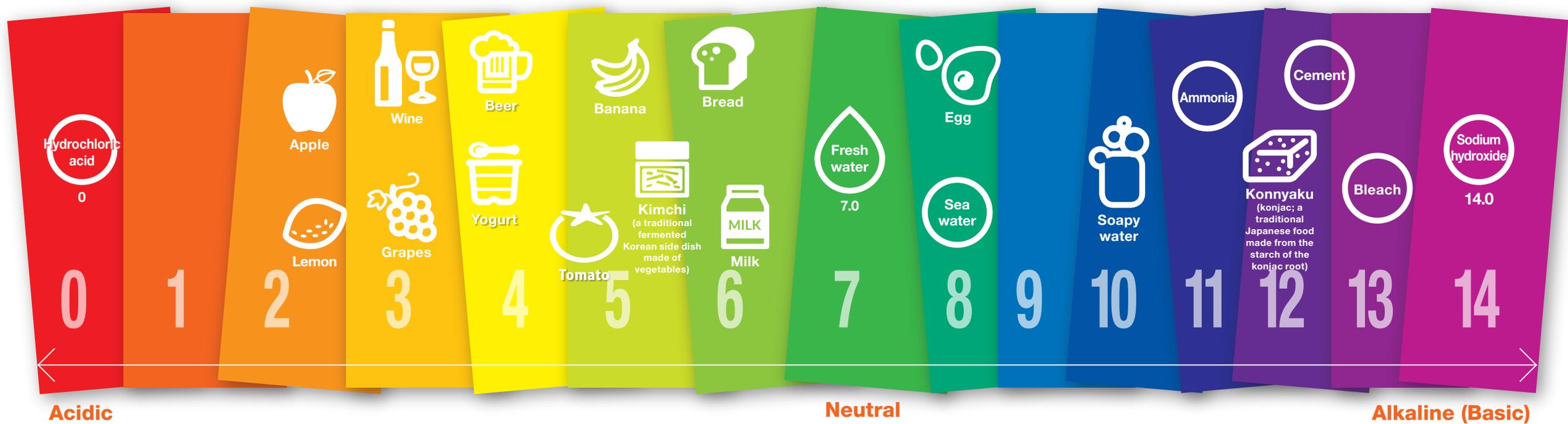
pH can provide a rough estimate of the acid value of strong acids, such as hydrochloric acid, but it is difficult to estimate the acid value of weak acids, such as organic acids, using pH.

For example, Orange A and Orange B have the same sugar levels (Brix), but different acid levels. This results in Orange B being very sour. However, even though the acid levels and flavor between Orange A and Orange B are quite different, there is not much difference between their pH values.



## pH Scale

The pH scale is as follows: acidic: 0, neutral: 7, and alkaline (basic): 14. pH values for some common foods and everyday items are illustrated below.



# Organic Acids and Inorganic Acids

## Inorganic Acids

Inorganic acid is a general term for acids which contain nonmetallic components such as chlorine, sulfur, nitrogen, and phosphorous. As with organic acids, inorganic acids can also be found naturally in many foods.

### Acetic acid

Colorless and transparent, with a distinctive pungent, sharp smell and sour taste. It is a principle component of vinegar. It is derived from the oxidation of alcohol by acetic acid bacteria.

### Citric acid

An organic acid that occurs in fruit, but is particularly abundant in citrus fruits. It is also used as an acidulant. Citric acid is the major component leading to the sour flavor of lemons and umeboshi. It has a somewhat astringent taste.

### Succinic acid

An organic acid which is largely found in sake (alongside lactic acid). It has a uniquely distinctive umami (savory), yet sour, taste. It is an essential component in the flavoring of sake.

## Organic Acids

An organic acid is an organic compound with acidic properties. They are acidic substances found in most foods. Some organic acids that naturally occur in foods include citric acid, malic acid, tartaric acid, succinic acid, ascorbic acid, lactic acid, acetic acid, and oxalic acid. Organic acids are also a component of fragrances so fruits with high acid levels are generally more fragrant.

### Ascorbic acid

An optically active compound. The L-enantiomer of ascorbic acid (L-ascorbic acid) is generally known as "vitamin C."

### Oxalic acid

The simplest dicarboxylic acid, it is abundantly found in plants. It is often used in titration, as it possesses reductive properties. It is also used as a raw material for dyes or for bleaching agent.

### Lactic acid

An organic acid which causes fermentation of lactose in milk when it is left unrefrigerated. It is a sour, colorless, and viscous liquid. It is used in the dye and pigment industry as a reducing agent, and in the food industry as an acidulant. A build-up of lactic acid in muscles causes fatigue.

### Malic acid

An organic acid found in fruit. It is largely found in apples and plums and is used as an acidulant. It has a characteristically light and refreshing sour taste.

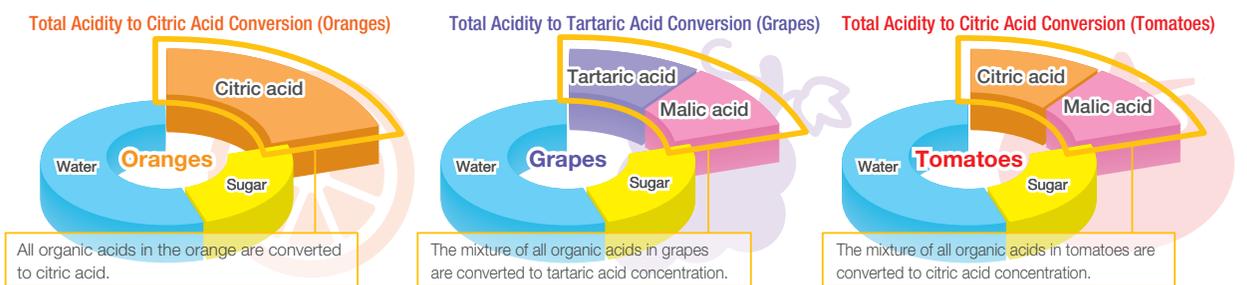
### Tartaric Acid

An organic acid, found predominately in grapes. It dissolves easily in water and alcohol. It is commonly combined with other organic acids and used as an acidulant (it is not used on its own for this). It has an intense sour taste.

## What is "Total Acidity Conversion?"

Many substances, including fruit, contain a mix of various organic acids. For example, it is said that vinegar contains an abundance of acetic acid, but in fact, there are other types of organic acids found in vinegar. The ratio of organic acids vary among different fruits. For example, oranges contain a large amount of citric acid, grapes containing tartaric and malic acid, and tomatoes contain citric and malic acid. Depending on the acid ratio, there may be slight

deviations when measuring. Rather than measuring each organic acid separately, organic acid is measured using a "total acidity conversion". For example, grapes contain a mix of tartaric and malic acid. By measuring the total acidity and converting to tartaric acid, the combination of the acids can be measured. Similarly, tomatoes contain an abundance of citric and malic acids, measuring the total acidity and converting to citric acid allows us to obtain the acid value.



# Acid Level Measurement Methods

## Acid-Base Titration Method (neutralization)



### Conventional Measurement Methods

- ✗ Simple measurement procedures
- ✗ No set-up required
- ✗ No reagent required
- ✗ No operational expenses
- ✗ Transportable and easy to carry
- ✗ Easy to read measurement values

### ● Acid-Base Titration Method (Neutralization)

Titration is the most orthodox method of measuring acid level. It involves the use of various equipment, such as burettes. Manual titration is done by hand, but automatic titrators are also available.

An alkaline (basic) solution is added to an acidic solution until the acidic solution gradually draws closer to a neutralization point. More alkaline solution is added, resulting in the formerly acidic solution surpassing the neutralization point and becoming completely alkaline.

In order to determine the neutralization point, 1 to 2 drops of a reagent (phenolphthalein), is added to the original solution. When the sample solution becomes alkaline, it triggers a reaction in the phenolphthalein, causing it to change color. It is possible to determine how much acid is contained in the original solution by observing the amount of alkaline solution that was added until the sample solution changed color (reached neutralization point).

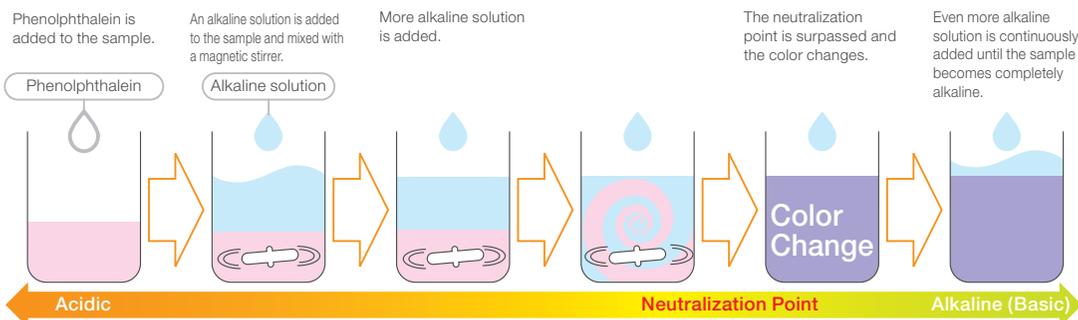
$$\text{Acid level} \times \text{Amount of acidic solution} \times \text{co-efficient} = \text{Concentration of alkaline solution} \times \text{Amount of added alkaline solution}$$

\* The amount of acidic solution, the concentration of alkaline solution, and the co-efficient have been determined beforehand, so it is possible to determine the acid level from the amount of added alkaline solution. The co-efficient will vary depending on the type of acid.

In contrast to manual titration, an automatic titrator utilizes a pH sensor which is inserted into the solution, rather than an indicator (phenolphthalein). As it is difficult to ascertain the point at which a solution's pH nears the neutralization point (7.0), it is common to add an alkaline solution until pH points of 8.2, 8.0, 7.8, or 7.2 are reached (according to the respective purpose).



### Acid-Base Titration (Neutralization) Method: Measurement Steps



# A Complete Comparison

## Electrical Conductivity Method (Acidity Meters & Brix-Acidity Meters)

### Acidity Meters & Brix-Acidity Meters: Quickly and Easily Used by Anyone

- Simple measurement procedures
- No set-up required
- No reagent required
- No operational expenses
- Transportable and easy to carry
- Easy to read measurement values

### ● Electrical Conductivity Method

ATAGO Acidity Meters measure the acid level in a sample through electrical conductivity. Our "hybrid" instruments, the Brix-Acidity Meters, measure both acid level and sugar level (Brix). The PAL-BX|ACID meters utilize two measurement principles: refractive index (nD) and electrical conductivity. The refractive method is used to measure the concentration (Brix) of a sample by observing how much light is reflected. The electrical conductivity method is used to measure the acid level of a sample by observing the flow of electrical current.

### ● Sugar Level (Brix)

The refractive index (nD) will vary depending on the concentration of a solution. Based on this general principle, ATAGO PAL-BX|ACID meters can display the Brix value.

### ● Acid Level

Our Brix-Acidity Meters utilize the relationship between the concentration of acid vs. the flow of electrical current to measure acid level. The acids found in fruit juices and wines are typically organic acids, which have the weakest electrolytes among the acids. As such, dilution (with distilled water) is required for measurement. Each unit is equipped with a unique measurement scale depending on the type of sample. Please select the model best suited for your sample.

\* Brix-Acidity Meters will display Brix results on top; acid level will be displayed directly below Brix results.

### Acid Level: Measurement Steps

#### Step ①

Apply some diluted sample on the sample stage.



#### Step ②

Press the START button. The sample's acid level will be displayed.



### Correlation Between Acid-base Titration and Electrical Conductivity

Although some users may be hesitant to switch to new methods for measuring acid levels, a distinct correlation exists between the acid-base titration method and the electrical conductivity method.

Sample	Acid Level (as listed on product label)	Vinegar Model	Automatic Titrator
Pure rice vinegar-company A	4.5	4.32	4.51
Grain vinegar-company B	4.2	4.25	4.28
Pure wine vinegar-company C	5.0	5.68	5.11
Pure black rice vinegar-company B	4.5	4.92	4.41
Kagoshima black rice vinegar-company D	4.2	4.07	4.49
Pure, unprocessed black vinegar (brown rice vinegar)-company E	4.5	4.15	4.74
Rinkokusan black vinegar-company C	4.2	4.51	4.05

# Acidity Meter & Brix-Acidity Meter

Sweet and Sour ~ Balance is the Key ~

Sweetness of fruit is often used for evaluating quality. Unfortunately, sweetness does not always mean that the fruit is tasty. Delicious fruits have the proper proportion of tartness and sweetness. Brix-Acid ratio indicates the maturation levels of fruits. Brix-Acid ratio is displayed by pressing a single button (R button), No need for complicated and troublesome calculations. Brix-Acid ratio = Brix% / Acidity%

## No Reagent Required

Conventional acid level measurement methods, (acid-base titration) are expensive, require complicated set-ups and disposal procedures, and need a large amount of costly reagent. ATAGO Acidity Meters & Brix-Acidity Meters require absolutely no reagent at all!



## Features A Backlit Screen

ATAGO Acidity Meters & Brix-Acidity Meters are equipped with a backlit screen. This allows for easy to read measurements, even in dimly lit or dark locations.



## Glassware is unnecessary

**Never take glass (on site) ever again**  
Titration method requires glassware which can pose danger if broken- few have voiced that they have actually broken one before. Have a peace of mind and be worry free of damage with ATAGO's Brix Acidity Meter.

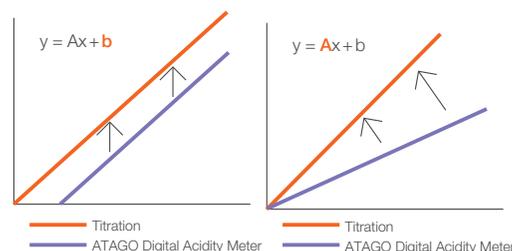


## Convenient Offset Feature

Even though there is a correlation among measurement values between acid-base titration and electrical conductivity, variations in measurement values may occur due to the difference in measurement principles.

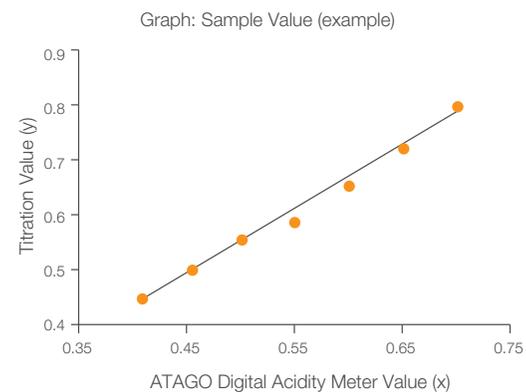
Because of this correlation, it is possible to receive values with the ATAGO Acidity and Brix-Acidity Meters that match up with acid-base titration values. The ATAGO Acidity and Brix-Acidity Meters are equipped with a convenient offset feature. \* A set value can be added or subtracted from the measured value to produce a reading which closely matches acid-base titration. A useful and convenient conversion graph can be created from the measurement values obtained from each method.

$y = A x + b$   
y: ATAGO Acidity Meter displayed value  
x: ATAGO Acidity Meter measurement value (Offset Feature disabled)  
A: Co-efficient  
b: Addition or subtraction



## Offset Feature - Application Example

In the event that variations in measurement values arise due to differences in measurement principles, measure the correlation between titration and our Acidity Meters in advance and input the correlation co-efficients (A) and (b). This will enable you to obtain measurement values which are directly correlated with titration values.



\* Multi-Fruit models (the PAL-BX|ACID F5 and the PAL-Easy ACID F5) are not equipped with the Offset Feature.

**Mango Model Coming Soon**

## Multi Fruits

Pocket Brix-Acidity Meter **PAL-BX|ACID F5**

Master Kit **Cat.No.7100**

Pocket Acidity Meter

**PAL-Easy ACID F5**

Master Kit **Cat.No.7300**



### Specifications

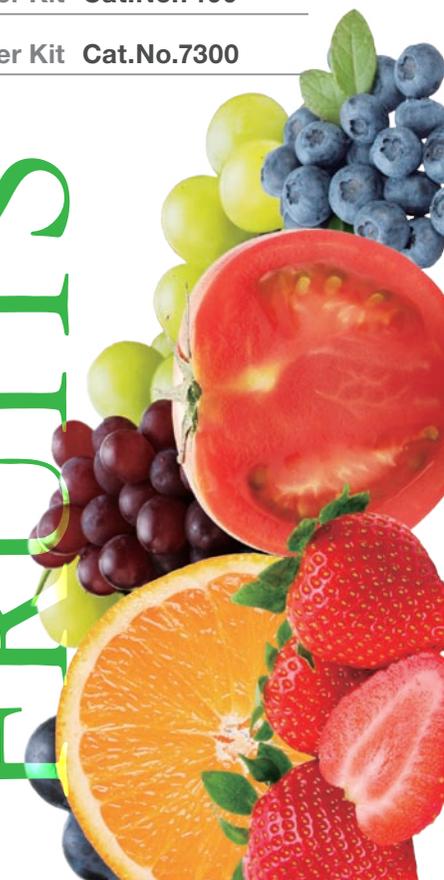
#### PAL-BX|ACID F5

Model	PAL-BX ACID F5		
Scale	Brix, Acid, Sugar / Acid ratio (displayed item)		
Measurement Range	Brix	0.0 to 60.0%	
	Acid	1L Low Acidity Citrus	0.10 to 4.00%
		1H High Acidity Citrus	2.50 to 8.80%
		2 Grape & Wine	0.10 to 4.00%
		3 Tomato	0.10 to 3.00%
		4 Strawberry	0.10 to 3.50%
		5 Blueberry	0.10 to 4.00%
	Temp	10.0 to 40.0°C	

#### PAL-Easy ACID F5

Model	PAL-Easy ACID F5		
Scale	Acid		
Measurement Range	Acid	1L Low Acidity Citrus	0.10 to 4.00%
		1H High Acidity Citrus	2.50 to 8.80%
		2 Grape & Wine	0.10 to 4.00%
		3 Tomato	0.10 to 3.00%
		4 Strawberry	0.10 to 3.50%
		5 Blueberry	0.10 to 4.00%
	Temp	10.0 to 40.0°C	

FRUITS



## Citrus

Pocket Brix-Acidity Meter **PAL-BX|ACID1**

Master Kit **Cat.No.7101**

Pocket Acidity Meter

**PAL-Easy ACID1**

Master Kit **Cat.No.7301**



### Specifications

#### PAL-BX|ACID1

Model	PAL-BX ACID1		
Scale	Brix, Acid (Total Acidity to Citric Acid Conversion), Sugar / Acid ratio (displayed item)		
Measurement Range	Brix	0.0 to 60.0%	
	Acid	1 Low Acidity Citrus	0.10 to 4.00%
		2 High Acidity Citrus	2.50 to 8.80%
	Temp	10.0 to 40.0°C	

#### PAL-Easy ACID1

Model	PAL-Easy ACID1		
Scale	Acid (Total Acidity to Citric Acid Conversion)		
Measurement Range	Acid	1 Low Acidity Citrus	0.10 to 4.00%
		2 High Acidity Citrus	2.50 to 8.80%
	Temp	10.0 to 40.0°C	

CITRUS



## Grape & Wine

Pocket Brix-Acidity Meter **PAL-BX|ACID2** Master Kit Cat.No.7102

Pocket Acidity Meter **PAL-Easy ACID2** Master Kit Cat.No.7302



### Specifications

#### PAL-BX|ACID2

Model	PAL-BX ACID2
Scale	Brix, Acid (Total Acidity to Tartaric Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.10 to 4.00% Temp 10.0 to 40.0°C

#### PAL-Easy ACID2

Model	PAL-Easy ACID2
Scale	Acid (Total Acidity to Tartaric Acid Conversion)
Measurement	Acid 0.10 to 4.00%
Range	Temp 10.0 to 40.0°C

## Strawberry

Pocket Brix-Acidity Meter **PAL-BX|ACID4** Master Kit Cat.No.7104

Pocket Acidity Meter **PAL-Easy ACID4** Master Kit Cat.No.7304



### Specifications

#### PAL-BX|ACID4

Model	PAL-BX ACID4
Scale	Brix, Acid (Total Acidity to Citric Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.10 to 3.50% Temp 10.0 to 40.0°C

#### PAL-Easy ACID4

Model	PAL-Easy ACID4
Scale	Acid (Total Acidity to Citric Acid Conversion)
Measurement	Acid 0.10 to 3.50%
Range	Temp 10.0 to 40.0°C

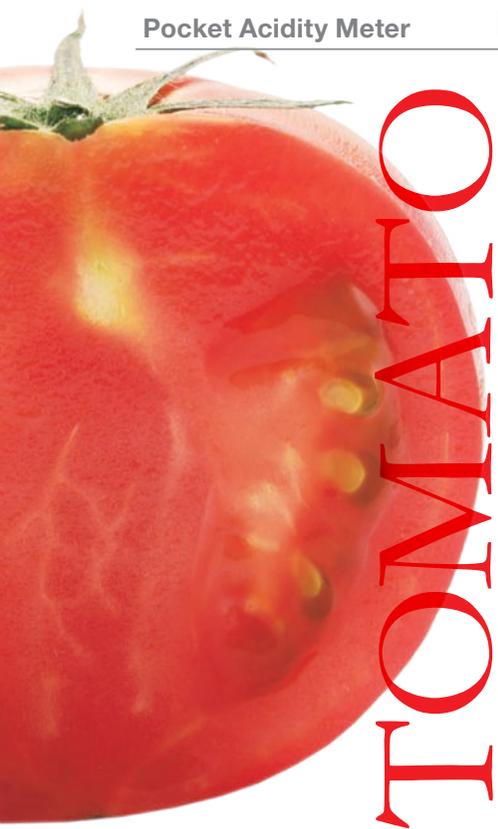
STRAWBERRY



## Tomato

Pocket Brix-Acidity Meter **PAL-BX|ACID3** Master Kit Cat.No.7103

Pocket Acidity Meter **PAL-Easy ACID3** Master Kit Cat.No.7303



### Specifications

#### PAL-BX|ACID3

Model	PAL-BX ACID3
Scale	Brix, Acid (Total Acidity to Citric Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.10 to 3.00% Temp 10.0 to 40.0°C

#### PAL-Easy ACID3

Model	PAL-Easy ACID3
Scale	Acid (Total Acidity to Citric Acid Conversion)
Measurement	Acid 0.10 to 3.00%
Range	Temp 10.0 to 40.0°C

## Apple

Pocket Brix-Acidity Meter **PAL-BX|ACID5** Master Kit Cat.No.7105

Pocket Acidity Meter **PAL-Easy ACID5** Master Kit Cat.No.7305



### Specifications

#### PAL-BX|ACID5

Model	PAL-BX ACID5
Scale	Brix, Acid (Total Acidity to Malic Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.10 to 4.00% Temp 10.0 to 40.0°C

#### PAL-Easy ACID5

Model	PAL-Easy ACID5
Scale	Acid (Total Acidity to Malic Acid Conversion)
Measurement	Acid 0.10 to 4.00%
Range	Temp 10.0 to 40.0°C

APPLE



# Banana

Pocket Brix-Acidity Meter **PAL-BX|ACID6** Master Kit Cat.No.7106

Pocket Acidity Meter **PAL-Easy ACID6** Master Kit Cat.No.7306



### Specifications

#### PAL-BX|ACID6

Model	PAL-BXIACID6
Scale	Brix, Acid (Total Acidity to Malic Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement Range	Brix 0.0 to 60.0% Acid 0.10 to 0.60% Temp 10.0 to 40.0°C

#### PAL-Easy ACID6

Model	PAL-Easy ACID6
Scale	Acid (Total Acidity to Malic Acid Conversion)
Measurement Range	Acid 0.10 to 0.60% Temp 10.0 to 40.0°C

# Kiwi

Pocket Brix-Acidity Meter **PAL-BX|ACID8** Master Kit Cat.No.7108

Pocket Acidity Meter **PAL-Easy ACID8** Master Kit Cat.No.7308



### Specifications

#### PAL-BX|ACID8

Model	PAL-BXIACID8
Scale	Brix, Acid (Total Acidity to Citric Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement Range	Brix 0.0 to 60.0% Acid 0.10 to 3.00% Temp 10.0 to 40.0°C

#### PAL-Easy ACID8

Model	PAL-Easy ACID8
Scale	Acid (Total Acidity to Citric Acid Conversion)
Measurement Range	Acid 0.10 to 3.00% Temp 10.0 to 40.0°C



# Blueberry

Pocket Brix-Acidity Meter **PAL-BX|ACID7** Master Kit Cat.No.7107

Pocket Acidity Meter **PAL-Easy ACID7** Master Kit Cat.No.7307



### Specifications

#### PAL-BX|ACID7

Model	PAL-BXIACID7
Scale	Brix, Acid (Total Acidity to Citric Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement Range	Brix 0.0 to 60.0% Acid 0.10 to 4.00% Temp 10.0 to 40.0°C

#### PAL-Easy ACID7

Model	PAL-Easy ACID7
Scale	Acid (Total Acidity to Citric Acid Conversion)
Measurement Range	Acid 0.10 to 4.00% Temp 10.0 to 40.0°C

# Pineapple

Pocket Brix-Acidity Meter **PAL-BX|ACID9** Master Kit Cat.No.7109

Pocket Acidity Meter **PAL-Easy ACID9** Master Kit Cat.No.7309



### Specifications

#### PAL-BX|ACID9

Model	PAL-BXIACID9
Scale	Brix, Acid (Total Acidity to Citric Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement Range	Brix 0.0 to 60.0% Acid 0.10 to 3.50% Temp 10.0 to 40.0°C

#### PAL-Easy ACID9

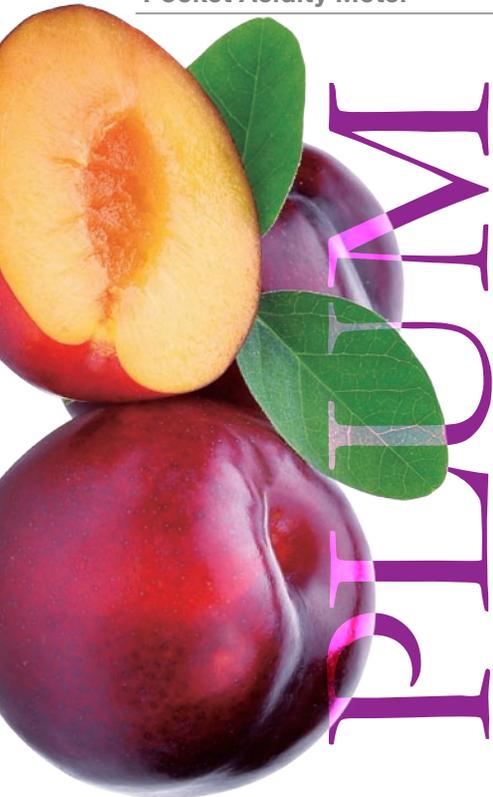
Model	PAL-Easy ACID9
Scale	Acid (Total Acidity to Citric Acid Conversion)
Measurement Range	Acid 0.10 to 3.50% Temp 10.0 to 40.0°C



**NEW** Plum

Pocket Brix-Acidity Meter **PAL-BX|ACID11** Master Kit Cat.No.7111

Pocket Acidity Meter **PAL-Easy ACID11** Master Kit Cat.No.7311



PLUM



**Specifications**

**PAL-BX|ACID11**

Model	PAL-BX ACID11
Scale	Brix, Acid (Total Acidity to Malic Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.10 to 4.00% Temp 10.0 to 40.0°C

**PAL-Easy ACID11**

Model	PAL-Easy ACID11
Scale	Acid (Total Acidity to Malic Acid Conversion)
Measurement	Acid 0.10 to 4.00%
Range	Temp 10.0 to 40.0°C

**NEW** Pear

Pocket Brix-Acidity Meter **PAL-BX|ACID14** Master Kit Cat.No.7114

Pocket Acidity Meter **PAL-Easy ACID14** Master Kit Cat.No.7314



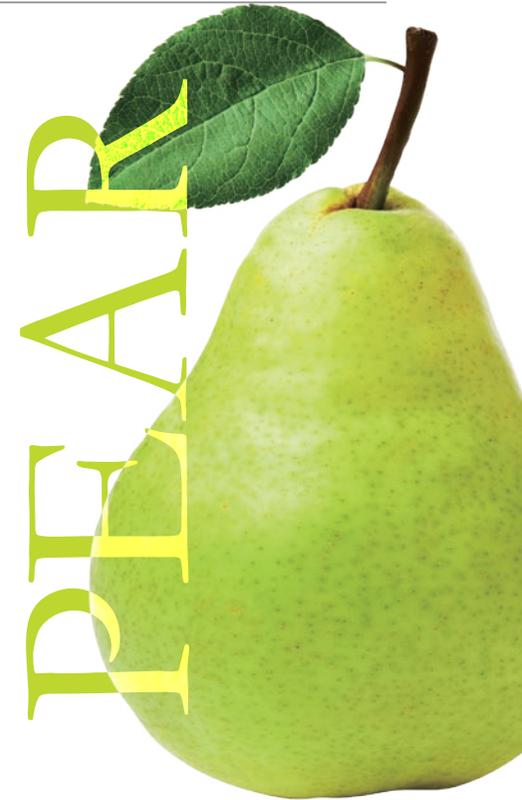
**Specifications**

**PAL-BX|ACID14**

Model	PAL-BX ACID14
Scale	Brix, Acid (Total Acidity to Citric Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.10 to 4.00% Temp 10.0 to 40.0°C

**PAL-Easy ACID14**

Model	PAL-Easy ACID14
Scale	Acid (Total Acidity to Citric Acid Conversion)
Measurement	Acid 0.10 to 4.00%
Range	Temp 10.0 to 40.0°C

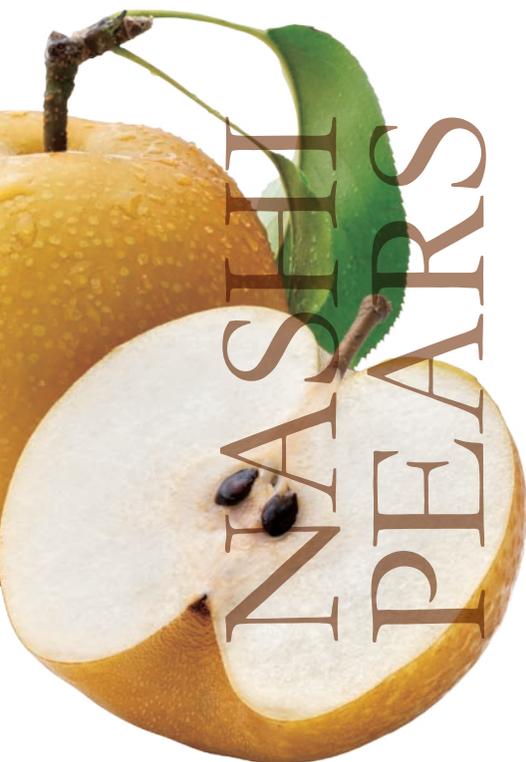


PEAR

**NEW** Nashi Pears (Asian Pear)

Pocket Brix-Acidity Meter **PAL-BX|ACID12** Master Kit Cat.No.7112

Pocket Acidity Meter **PAL-Easy ACID12** Master Kit Cat.No.7312



NASHI PEARS



**Specifications**

**PAL-BX|ACID12**

Model	PAL-BX ACID12
Scale	Brix, Acid (Total Acidity to Citric Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.05 to 2.00% Temp 10.0 to 40.0°C

**PAL-Easy ACID12**

Model	PAL-Easy ACID12
Scale	Acid (Total Acidity to Citric Acid Conversion)
Measurement	Acid 0.05 to 2.00%
Range	Temp 10.0 to 40.0°C

<Measurement accuracy >

Asian Pear : ±0.05% (0.05 to 0.50%),  
Relative precision ±5% (0.51% or more)

Kosui : ±0.05% (0.05 to 0.48%),  
No accuracy guarantee (0.49% or more)

Coffee Cherry

Pocket Brix-Acidity Meter **PAL-BX|ACID40** Master Kit Cat.No.7140

Pocket Acidity Meter **PAL-Easy ACID40** Master Kit Cat.No.7340



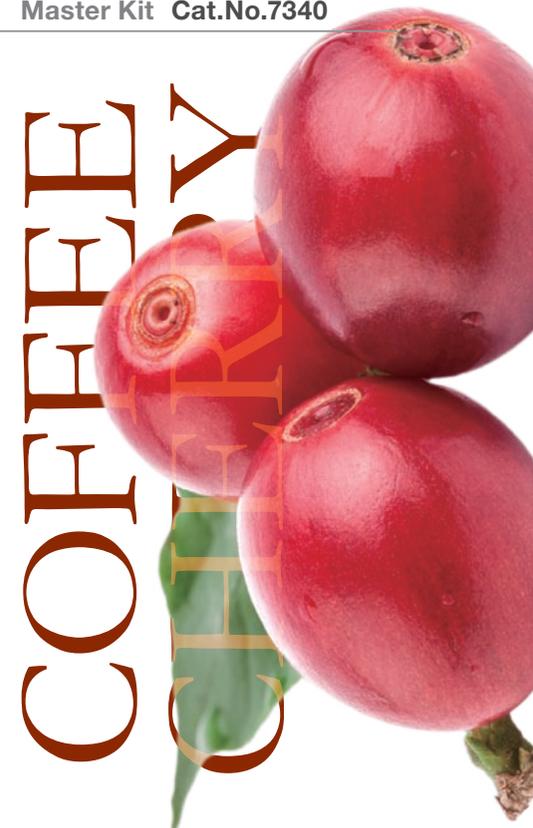
**Specifications**

**PAL-BX|ACID40**

Model	PAL-BX ACID40
Scale	Brix, Acid (Total Acidity to Chlorogenic Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.10 to 1.90% Temp 10.0 to 40.0°C

**PAL-Easy ACID40**

Model	PAL-Easy ACID40
Scale	Acid (Total Acidity to Chlorogenic Acid Conversion)
Measurement	Acid 0.10 to 1.90%
Range	Temp 10.0 to 40.0°C



COFFEEY

# Milk

Pocket Brix-Acidity Meter **PAL-BX|ACID91** Master Kit Cat.No.7191

Pocket Acidity Meter **PAL-Easy ACID91** Master Kit Cat.No.7391



### Specifications

#### PAL-BX|ACID91

Model	PAL-BX ACID91
Scale	Brix, Acid (Total Acidity to Lactic Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.10 to 0.30% Temp 10.0 to 40.0°C

#### PAL-Easy ACID91

Model	PAL-Easy ACID91
Scale	Acid (Total Acidity to Lactic Acid Conversion)
Measurement	Acid 0.10 to 0.30%
Range	Temp 10.0 to 40.0°C

# Beer

Pocket Brix-Acidity Meter **PAL-BX|ACID101** Master Kit Cat.No.7501

Pocket Acidity Meter **PAL-Easy ACID101** Master Kit Cat.No.7701



### Specifications

#### PAL-BX|ACID101

Model	PAL-BX ACID101
Scale	Brix, Acid (Total Acidity Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.10 to 20.0% Temp 10.0 to 40.0°C

#### PAL-Easy ACID101

Model	PAL-Easy ACID101
Scale	Acid (Total Acidity Conversion)
Measurement	Acid 0.10 to 20.0%
Range	Temp 10.0 to 40.0°C

# Yogurt

Pocket Brix-Acidity Meter **PAL-BX|ACID96** Master Kit Cat.No.7196

Pocket Acidity Meter **PAL-Easy ACID96** Master Kit Cat.No.7396



### Specifications

#### PAL-BX|ACID96

Model	PAL-BX ACID96
Scale	Brix, Acid (Total Acidity to Lactic Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.10 to 3.00% Temp 10.0 to 40.0°C

#### PAL-Easy ACID96

Model	PAL-Easy ACID96
Scale	Acid (Total Acidity to Lactic Acid Conversion)
Measurement	Acid 0.10 to 3.00%
Range	Temp 10.0 to 40.0°C

# Sake

Pocket Brix-Acidity Meter **PAL-BX|ACID121** Master Kit Cat.No.7521

Pocket Acidity Meter **PAL-Easy ACID121** Master Kit Cat.No.7721



### Specifications

#### PAL-BX|ACID121

Model	PAL-BX ACID121
Scale	Brix, Acid (Total Acidity Conversion), Sugar / Acid ratio (displayed item)
Measurement	Brix 0.0 to 60.0%
Range	Acid 0.50 to 25.0% Temp 10.0 to 40.0°C

#### PAL-Easy ACID121

Model	PAL-Easy ACID121
Scale	Acid (Total Acidity Conversion)
Measurement	Acid 0.50 to 25.0%
Range	Temp 10.0 to 40.0°C

# Vinegar

Pocket Brix-Acidity Meter **PAL-BX|ACID181** Master Kit Cat.No.7581

Pocket Acidity Meter **PAL-Easy ACID181** Master Kit Cat.No.7781



# VINEGAR



## Specifications

### PAL-BX|ACID181

Model	PAL-BX ACID181
Scale	Brix, Acid (Total Acidity to Acetic Acid Conversion), Sugar / Acid ratio (displayed item)
Measurement Range	Brix 0.0 to 60.0% Acid 0.50 to 12.0% Temp 10.0 to 40.0°C

### PAL-Easy ACID181

Model	PAL-Easy ACID181
Scale	Acid (Total Acidity to Acetic Acid Conversion)
Measurement Range	Acid 0.50 to 12.0% Temp 10.0 to 40.0°C

## Common Specifications

Scale	Brix* <sup>1</sup> , Acid, Sugar / Acid ratio (displayed item)	Automatic Temperature Compensation Range	10 to 40°C
Measurement Range	Brix* <sup>1</sup> 0.0 to 60.0%	Power Supply	Two (2) AAA alkaline batteries
Measurement Accuracy	Brix* <sup>1</sup> ± 0.2% Acid* <sup>2</sup> ± 0.10% (Acid 0.10 to 1.00%) Relative precision : ±10% (Acid 1.01% or more)	International Protection Class	IP65
Resolution	Brix* <sup>1</sup> 0.1% Acid 0.01% (0.00 to 9.99%) 0.1% (10.0% or more) Sugar / Acid ratio* <sup>1</sup> 0.00 (0.00 to 9.99) 00.0 (10.0 to 99.9) 000 (100 or more)	Dimensions and Weight	55(W) × 31(D) × 109(H)mm, 100g (main unit only)

\*<sup>1</sup> "Brix" and "Brix-Acid Ratio" scales are available only on Brix-Acidity Meters.  
\*<sup>2</sup> Except PAL-BX|ACID12 and PAL-Easy ACID12. **P.B16** →



## Free Demo Unit Available

Interested in using a measurement method that's easier and quicker than the conventional titration method? Give ATAGO Acidity Meters or Brix-Acidity Meters a try!

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overseas@atago.net

## Pocket Brix-Acidity Meter PAL-BX|ACID Series & Pocket Acidity Meter PAL-Easy ACID Series

## Kits & Accessories

### Master Kit



This Master Kit includes everything you need for easy, precise and accurate measurements.

### Content

Unit + included accessories (Digital scale × 1, 100mL Beaker (PMP) × 1 and 1mL Measuring spoon × 1)

### Optional Accessories

Parts No.	Part name	Parts No.	Part name
RE-130004	Reference solution	RE-39004	100mL Beaker (PMP)
RE-39450	Digital scale	RE-39005	1mL Measuring spoon

## Measurement Method (PAL-BX|ACID)

\* Dilution ratio will vary depending on the scale.

### 1 Measuring the Brix



Apply at least 0.3mL of sample.



Press START. Brix results will be displayed.

\* Be sure to thoroughly clean and wipe off the sample stage after taking measurements.

### 2 Preparing a dilution for acid level measurement



Weigh out approx. 1.00g of sample. Add distilled water until the total desired weight (dilution ratio)\* is reached. Stir well.

### 3 Measuring the acid level



Apply at least 0.3mL of the diluted sample.



Press START. Acid level results will be displayed.

### 4 Displaying the Brix-Acid Ratio



Press the Brix-Acid Ratio button. Brix-Acid ratio results will be displayed.

\* For Acidity Meters, skip "1 Measuring the Brix" and follow measurement steps "2 Preparing a dilution for acid level measurement" & "3 Measuring the acid level."

### How to Switch Scales on the Multi-Fruit Models



Press and hold the Brix-Acid Ratio button until the scale selection screen is displayed (after 5 seconds).



Use the START and ZERO buttons to select the desired scale.



Press the Brix-Acid Ratio button once more to confirm the selection.

# Acidity Meter & Brix-Acidity Meter FAQ

## Q Should I choose an Acidity Meter or a Brix-Acidity Meter?

A We recommend a Brix-Acidity Meter for users who wish to measure both Brix and acid level.

If Brix measurements are unnecessary, we recommend an Acidity Meter.

If you are unable to find an appropriate model for the acid level of the fruit or other sample you wish to measure, feel free to contact ATAGO.

## Q What is the unit display (readout) of the acid level?

A The acid level value is expressed in g/100mL (%).

## Q Tell me about sample preparation procedures or any measurement tips I should be aware of.

A Sample preparation procedures and measurement tips will differ, depending on the sample. However, please use the following as reference: when measuring acid level with an ATAGO Acidity Meter or Brix-Acidity Meter, it is necessary to dilute the sample. If you have any additional questions or concerns, please contact us.



### Tomatoes and Grapes

Sample prep. : crush (unpeeled) and filter through a sieve or coffee filter.



### Apples and Kiwi

Sample prep. : grate (unpeeled) and filter through a sieve or coffee filter.



### Oranges and Citrus Fruits

Sample prep. : cut in half, use a citrus squeezer / juicer to extract the juice and filter through a sieve or coffee filter.



### Pineapples

Sample prep. : peel, crush (fruit only) and filter through a sieve or coffee filter.



### Canned Tomatoes

Sample prep. : crush (fruit only) and filter through a sieve or coffee filter.

\* Unsalted/additive free canned tomatoes only



### Yogurt

Sample prep. : dilute then measure.



### Jams, Jellies and Purees

Sample prep. : filter through a sieve or coffee filter.

\* Unsalted/additive free samples only; additives or substances such as salt will affect the electrical conductivity.

