

Measuring ripeness in the fruit and vegetable industry - Measuring Brix using refractometry -

Introduction

Often it is not sufficient to test how ripe fruit and vegetables are by using your senses, assessing appearance, odour and texture. It is, however, possible to accurately measure the sugar concentration in **degrees Brix**.

To do this, it is useful to have analytical instruments that use only a little cell sap as a sample, are small and handy and can be used by untrained personnel.

Degrees Brix

A degree Brix, also known as °Brix, Brix, %Brix, is a unit of measurement for the sugar concentration of liquids. It can be measured by both the density and the refractive index (nD).

Degrees Brix is mostly used in the fruit industry, but also for determining the must weight in winemaking in English-speaking countries. It is used for fruit juices, drinks and other sugar-rich products. These products contain mostly various sugars, particularly glucose, fructose and sucrose in addition to water.

However, various acids, such as citric or malic acid, as well as polymer sugars also affect density and the refractive index. We are therefore dealing with an easy to manage sum parameter.

Degrees Brix are named after the Austro-German scientist Adolf Ferdinand Wenceslaus Brix (1798-1870), who developed the unit in 1870. A liquid has one degree Brix (=1% Brix) if it has the same refractive index as a solution of 1g sucrose in 100g of sucrose water solution. It has 10 Brix (=10% Brix) if the nD is of a solution of 10g sucrose in 100g of sucrose water solution (equal to a ten percent solution).

1 °Brix \approx 1 °Balling (archaic) \approx 4 °Oe \approx 1.3345 nD

Which devices should be used?

For quick on-site measurements, **digital hand refractometers** are recommended. They are light and convenient, measure the Brix value at the touch of a button and are equipped with temperature compensation. Nevertheless it is helpful to take the measurement as close as possible to 20°C. The juice from fruit or vegetable samples can be dropped straight on to the measuring surface and measured immediately.

A few drops (0.2ml) are enough for a measurement.

That is the case for all the measuring devices shown here. They vary in size, weight (1) accuracy (2) and measurement range (3).



DR301-95	DR201-95	DR101-60
500 g	200 g	160 g (1)
±0.1	±0.2	±0.2 °Brix (2)
0-95	0-95	0-60 °Brix (3)

The advantages at a glance:

- small, mobile handheld devices
- with temperature compensation (10-40°C)
- do not rely on a light source (in contrast to analogue handheld refractometers)
- waterproof casing (DR101-60 only)
- mains adaptor and PC interface (DR 301-95 only)

Harvest-fresh pineapple, for example, has a Brix measurement of approximately 13 °Brix. Natural degreening occurs during transportation, meaning that this value can rise to up to 15 °Brix.

This degreening process is not visible from the outside, but can be measured. Typical measurement values for a harvest-fresh pineapple on delivery are 14.2 to 14.7 °Brix. If the measurement value is clearly below this range, the fruit is poor quality. High Brix values indicate a sweeter taste and that the fruit or vegetable will keep for longer.

Quality	Poor [°Brix]	Average [°Brix]	Good [°Brix]	Very Good [°Brix]
Strawberries	8	12	16	18
Apples	6	10	14	18
Melons	8	12	16	18
Blueberries	4	8	16	22
Asparagus	4	6	8	10
Corn	6	10	18	24

Examples of typical measurement values for different fruits and vegetables

EC marketing standards provide specific Brix values for kiwis, melons and water melons in order to establish the harvest-ripeness of these fruits (measured according to EU marketing standards (EU) No. 543/2011 Annex 1, Part B - Part 3 (version: 22/06/2011)).

Digital table refractometer

Digital table refractometers are also used in measuring ripeness. They are always used if any of the following requirements must be met:

- Accuracy of at least 0.1 °Brix
- Automatic temperature control
- Ability to enter sample code
- Data storage with traceability
- User management that makes it possible to document the user with every measurement
- Data transfer to PC, printer or onto a higher-level network



DR6000-T

DR6000-T type devices are very robust and are protected from soiling by a coating.

They are operated simply using a touch screen and, due to the installation of a sapphire prism, are exceptionally scratch-resistance and durable. A Peltier element precisely controls the temperature of the sample, whether it is cold from the cold-storage room or warm, having come directly from shipping space or production.

Even untrained personnel can produce reliable measurement results using a table refractometer from the DR6000-T series.

Cleaning and calibration

A refractometer's prism can be cleaned very easily with a cellulose cloth and, if necessary, distilled water. Distilled water can also be used to calibrate the measurement device.

A.KRÜSS also offers a series of further standards with certificates. The external calibration, which should be carried out annually, can take place cost effectively in the factory or, if desired, at the customer's premises.

Further uses

The concentration of oils, lubricants and cooling liquids can also be calculated using the refractometer. Although this use is not intended for measuring sugar concentration, degrees Brix are used (as a scale) for a quick and simple method of measuring concentration. Using this method it is also possible to measure the quality of oils, estimate the operating life of used oils or the dilution of lubricants and cooling liquids from concentrate.