



Density Measurement with Anton Paar Density Meters in Apple Juice Concentrate Production

Relevant for: Beverage Industry

Density meters of the DMA M Generation represent a fast, accurate and user-friendly method to monitor the production steps during juice manufacturing. Numerous possibilities for custom-tailored sample filling are available.



Industrial production of apple juice

On a large scale, apple juice, and other fruit juice, is produced from aroma essence and juice concentrate by mixing these with water.

The fruits are washed, mashed and pressed in a fruit press to extract the juice. The aroma essence is removed from the resulting crude juice by distillation. The remaining turbid liquid is cleared by filtration or chemically and evaporated to a honey-like concentrate of about 70 °Brix, i.e. 70 %w/w sugar.

The concentrate and aroma essence are shipped to juice producers and diluted there with water to the final product of 9 °Brix to 12 °Brix. Transporting concentrate and aroma essence instead of the final beverage helps the fruit juice producers save shipping costs.

Quality control via density measurement

Density measurement and subsequent conversion into concentration values is used for quality control throughout the production process.

The digital density meters DMA 4100 M, DMA 4500 M and DMA 5000 M from Anton Paar are shown in **Figure 1**. These instruments provide highly accurate, reliable and fast measurement results. The data such as %v/v alcohol, °Brix, density, specific gravity, etc., can be displayed, stored and sent to a printer, USB stick, PC or LIMS.

Little to do, but much to gain

DMA 4100 M, DMA 4500 M and DMA 5000 M allow the simple determination of various quality parameters, e.g. alcohol content or sugar content.

The density meters are easy to operate: Just set the measuring method, fill in the sample, wait for half a minute and receive the results as you require them - accurate, reliable, in the unit of your choice.

DMA 4100/4500/5000 M instruments also have an audit trail function built in that meets FDA requirements. All operation steps can be documented and stored in a tamper-proof log file.



Fig. 1 The DMA M family

Samples of low viscosities can be filled into the measuring cells of DMA 4100/4500/5000 M automatically with the Xsample 22 Sample Filling Unit or the Xsample 122 Sample Changer (see **Figure 2**).

Samples of higher viscosities can easily be filled using the Xsample 340 Filling and Rinsing Unit (**Figure 3**) or the Xsample 530 Sample Changer. After each measurement,

the measuring cell is automatically cleaned with up to three rinsing agents, and dried. The cleaning procedure can be adapted to the respective needs.



Fig. 2 DMA M and Xsample 122 Sample Changer

Alcohol content of the aroma essence

The aroma essence obtained from distillation contains alcohol and small amounts of other components such as aroma. The density measurement is used to determine the alcohol content by means of a table. A large selection of built-in alcohol tables is available, e.g. OIML, IUPAC, KAEMPF, AOAC, Proof and HM C&E alcohol tables.



Fig. 3 The Xsample 340 Filling and Rinsing Unit

How sweet is your juice?

After removal of the aroma essence, the turbid crude juice is tested for its sugar content to control the production process. Filtration of the sample may be necessary to achieve a higher precision. The concentrate is also characterized by determining its sugar content. Treating the concentrate sample in an ultrasonic bath removes any air bubbles to ensure correct density measurement.

The DMA M series features °Brix, °Plato and °Baumé tables for the determination of the sugar content.

Concentration determination of other solutions used

Alcohol solutions that are used for cleaning and disinfection of pipes, containers, etc. must have a minimum alcohol content for maximum microbiological action. The concentration of these solutions can be controlled by means of density measurement. Densities of any other liquid, e.g. acids or bases, can also be measured and converted into concentration units.

DMA Generation M models at a glance

Uncertainty of measurement

DMA 4100 M:

Density: 0.0001 g/cm³
Sugar concentration: 0.025 °Brix
Alcohol content: 0.05 %v/v alcohol

DMA 4500 M:

Density: 0.00005 g/cm³
Sugar concentration: 0.015 °Brix
Alcohol content: 0.025 %v/v alcohol

DMA 5000 M:

Density: 0.000005 g/cm³
Sugar concentration: <0.01 °Brix
Alcohol content: <0.01 %v/v alcohol

Contact Anton Paar GmbH:

Tel: +43 316 257-0
density@anton-paar.com
www.anton-paar.com