CHEMOMETRY IN FRUIT JUICES, NECTARS AND PUREES

The consumption of juices is widely extended around the world, being, in addition to a refreshing and healthy drink, an important source of beneficial compounds for health. The quality of the juices is directly related to their composition, which in turn depends on the type and variety of fruit used. Legislation relating to the quality of food is especially demanding in terms of traceability of its origin, as well as its composition. The most frequent adulterations in fruit juices and derivatives include false declarations of origin, dilution with water, addition of sugars, acids or juices of less value, the latter being a practice with significant economic impact. Producers of processed fruits and vegetables must implement analytical tools that allow them to ensure both the real origin and the quality of the product used or its adulteration.

Each fruit and vegetable, depending on its species, variety and origin, presents a specific composition profile that can be used to detect the presence of a product that does not meet the expected specifications. In particular, the profile of sugars (sucrose, glucose, fructose, sorbitol) and that of organic acids (malic, lactic, citric, isocitric, tartaric and others) can be used to detect mixtures or additions not declared in matrices such as juices, nectars and fruit purees. During fruit processing, these profiles have the advantage of being relatively stable (in the absence of fermentation) against oxidation or other alterations. Furthermore, they can be easily measured with high precision independently, either by specific enzymatic procedures or after chromatographic separation processes.

The simultaneous determination of these parameters and their comparison with known profiles using multivariate statistical methods (in particular the so-called PCA, Principal Component Analysis, and HCA, Hyerarchical Cluster Analysis) is called chemometrics. This type of data treatment makes it possible to evaluate aspects as specific as geographical origin, sensory and nutritional properties, or the existence of adulterations. In some cases, complex instrumental techniques are required (HPLC, isotope exchange, FT-IR) that require a high technical level, but it is possible to use simpler methods to reliably collect the different data to be used, such as UV-VIS spectroscopy.

To facilitate the analysis, the AIJN-European Fruit Juice Association publishes different reference guides depending on the type of juice in which, in addition to the maximum and minimum values, specific data regarding the expected values that take into account the differences are detailed. between varieties, as well as throughout the ripening process. The following table, drawn up from different bibliographic sources, shows by way of example the profiles corresponding to several common juices, in which the differences between them can be confirmed.

	Lemon (5)	*Strawberry (1)*	*Cherry (1)*	*Blueberry (1)*	*Tomato (2)*	*Peach (1)*	*Grape (1)*	*Apple (1)*	*Orange (4)*	*Pear (1)*	*Pineapple (3)*
Sucrose	18%	25%	0%	0%	2%	70%	1%	20%	35%	25%	75%
Glucose	29%	35%	49%	48%	48%	12%	49%	20%	16%	15%	9%
Fructose	32%	40%	39%	51%	48%	13%	51%	56%	18%	33%	11%
Sorbitol	0%	0%	10%	0%	0%	3%	0%	3%	0%	30%	0%
Total Sugar (g/L)	25	57	131	117	25	101	187	124	49	122	70
Fructose/Glucose	1,2	1,2	0,8	1,1	1,0	1,1	1,0	2,8	1,1	2,2	1,3
Sucrose /(Glu+Fru)	0,30	0,33	0,00	0,00	0,02	2,80	0,01	0,26	1,00	0,52	3,75
Malic	1%	24%	98%	4%	11%	46%	21%	82%	7%	50%	13%
Citric	96%	75%	2%	81%	53%	21%	4%	3%	76%	25%	87%
Tartaric	0%	0%	0%	0%	0%	0%	74%	0%	0%	0%	0%
Total Acidity (pH 8.1) (g/L)	89	85	112	79	15	57	90	57	17	40	15
Total Sugar / Total Acidity	0,28	0,67	1,17	1,48	1,67	1,77	2,08	2,18	2,88	3,05	4,67

Some of these components are authentic markers of identity due to their high concentration in some fruits and practically their absence in others. It is evident when analyzing the table to detect some of the adulterations that can occur when substituting juices of high economic value (such as those of red fruits) for other more affordable ones. For example, the presence of tartaric acid in a juice is a very evident sign of the presence of grape juice, since this acid does not appear in any other fruit; The same could be said of the presence of sorbitol, a sugar whose presence is very significant in pear juice, but practically absent in other fruits.

In other cases, the relative proportions between some parameters are indicative enough to indicate the presence of factors that can alter them. Thus, the relationship between glucose and fructose generally remains close to 1, but a higher value could suggest the presence of apple and / or pear juice; or a ratio between sucrose and glucose + high fructose would be characteristic of peach and / or pineapple juice.

Other acids deserve a separate mention that, although they do not offer information regarding authenticity, they do provide us with data on the quality of the processing, such as ascorbic acid (which is an indicator of the freshness of the juice, since it degrades throughout the time), acetic acid (which could be indicative of a fermentation process started) or D-lactic acid, which would point to contamination by lactic bacteria.

Sinatech offers a range of highly reliable and precise enzymatic reagents for the specific and precise determination of sugars and acids in fruit juices and derivatives accepted among the official methods of analysis for fruits and vegetables included in the Stanley Codes (CDX-247). The Dionysos system offers producers of packed juices, nectars and purees an optimal tool for the control of the production process and the detection of adulterations, capable of guaranteeing the quality and food safety requirements demanded by the existing regulations.

References:

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