NMR FOODSCREENER

Juice Profiling 4.0

Authenticity Analysis and Quality Control of Fruit and Vegetable Juices

Innovation with Integrity

Enhance fruit juice analysis efficiency using Nuclear Magnetic Resonance (NMR) technology. This technique enables simultaneous and rapid assessment of numerous parameters, with straightforward and cost-effective sample preparation, all while eliminating the need for organic solvents.

Introducing Juice Profiling™: A Cutting-Edge NMR-Based Screening Method for Fruit and Vegetable Juices

At the forefront of scientific innovation, Juice Profiling™emerges as a groundbreaking NMR-based screening technique meticulously crafted through a collaborative effort by Bruker BioSpin GmbH and SGF International e.V.

This method revolutionizes the evaluation of fruit and vegetable juices, providing a comprehensive and efficient solution for quality assessment and authenticity verification.

- IFU Method 87
- Floor standing 400MHz NMR FoodScreener Platform
- Equipped with a 60 position sample changer
- Compatible with Food Modules for Juice, Wine, and Honey

Features

- **IFU Method 87:** The International Fruit and Vegetable Juice Association (IFU) recognizes NMR as an official and innovative method which enables the simultaneous determination of components such as sugars and organic acids across a wide range of matrices.
- **Simultaneous Multidimensional Assessment:** For every juice sample, Juice Profiling™ simultaneously scrutinizes a multitude of parameters related to quality and authenticity. This holistic approach allows us to extract valuable insights from a single data set acquired within mere minutes.
- **Streamlined Process:** Traditional Juice Authenticity and Quality Control Analysis can be laborious, involving a myriad of analytical instruments and methods. However, the NMR Juice-Profiling method streamlines this process, significantly reducing time and effort. By consolidating multiple conventional methods into a single analysis, it optimizes efficiency and cost-effectiveness. Robust quantitative analysis of authenticity-related parameters is now achievable with unprecedented ease.
- **Authenticity Insights:** Beyond quantitative data, Juice Profiling™ provides invaluable authenticity insights. Statistical evaluation of NMR profiles, coupled with our extensive database of nearly 50,000 reference samples, ensures robust confirmation of juice authenticity.
- **Workflow Efficiency:** Juice Profiling 4.0 boasts a routine, straightforward workflow. It automatically analyzes over 60 samples in a single run, minimizing sample preparation time and eliminating the need for organic solvents.
- **Versatility:** Whether it's fruit or vegetable juices, our method discerns authenticity comprehensively. From assessing origin to quantifying constituents, Juice Profiling™ offers a unique and cost-effective solution.

Unique Advantages:

NMR can replace many conventional methods for the quantitative check. This allows for enormous time and cost savings.

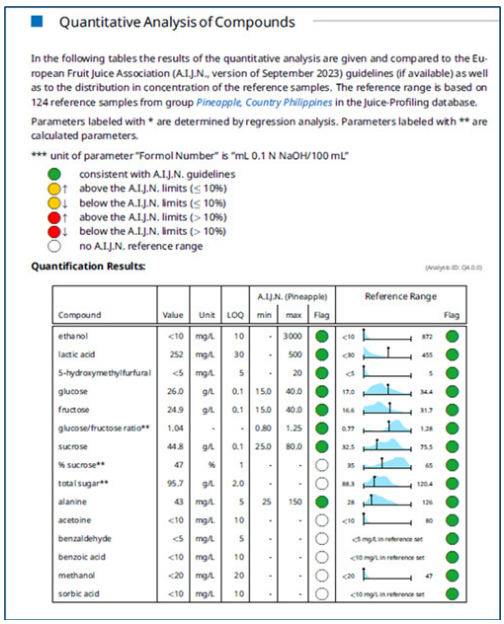
- Ease of use
- Minimal sample preparation with no hazardous substances required
- Fully automated workflow from sample to report
- No NMR knowledge required for daily operation, very simple to use in routine analysis

Parameter	Check for	Conventional method	Approx. Costs (€) of conventional method
Ethanol	Spoilage	IFU 02 (GC) or enzymatic	50,-
Lactic acid	Spoilage	IFU 53 (enzymatic)	50,-
HMF	Heat mistreatment	IFU 69 (HPLC)	75,-
Fumaric acid	Spoilage	IFU 72 (HPLC)	75,-
Glucose	Quality / sugar addition	IFU 55 (enzymatic) or IC	55,-
Fructose	Quality / sugar addition	IFU 55 (enzymatic) or IC	
Sucrose	Quality / sugar addition	IFU 56 (enzymatic) or IFU 67 (HPLC)	
Malic acid	Quality	IFU 21 (enzymatic)	55,-
Citric acid	Quality / acid addition	IFU 22 (enzymatic)	55,-
Arbutin	Carry-over foreign fruit	*Lab. Internal (HPLC)*	100,-
Phlorin	Overextraction *Citrus*	*Lab. Internal (HPLC)*	100,-
Alanine	Quality	IFU 57 (column chromatography), Amino Acid Analyser	50,-
Galacturonic acid	Quality / excessive enzymation (use of pectinase)	IFU 78 (HPAEC-PAD)	75,-

Figure 1: Example of quantitative parameters all covered by the NMR Juice-Profiling method

Quantitative and Statistical Analysis of Authenticity

- Quantitative analysis of multiple juice constituents, pertaining to authenticity
- Verification of fruit type
- Verification of country of origin
- Verification of product type: From Concentrate vs Not from Concentrate juices
- Verification of fruit content
- Detection of blends
- Detection of atypical profiles: deviations to reference samples



Quantitative Analysis of Compounds

In the following tables the results of the quantitative analysis are given and compared to the European Fruit Juice Association (A.I.J.N., version of September 2023) guidelines (if available) as well as to the distribution in concentration of the reference samples. The reference range is based on 124 reference samples from group *Pineapple, Country Philippines* in the Juice-Profiling database.

Parameters labeled with * are determined by regression analysis. Parameters labeled with ** are calculated parameters.

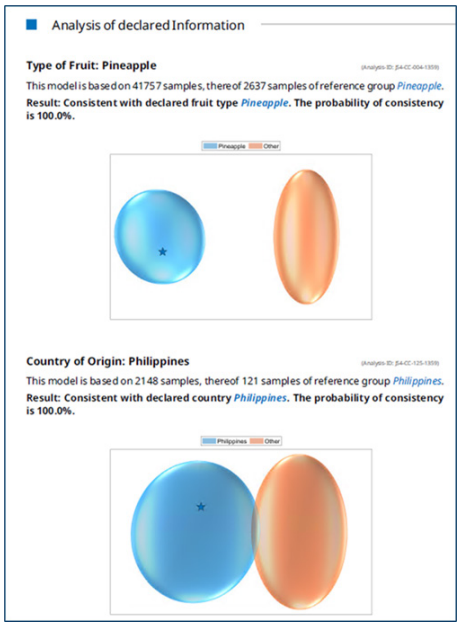
*** unit of parameter "Formol Number" is "mL 0.1 N NaOH/100 mL"

- consistent with A.I.J.N. guidelines
- ↑ above the A.I.J.N. limits (≤ 10%)
- ↓ below the A.I.J.N. limits (≤ 10%)
- ↑ above the A.I.J.N. limits (> 10%)
- ↓ below the A.I.J.N. limits (> 10%)
- no A.I.J.N. reference range

Quantification Results:

Compound	Value	Unit	LOQ	A.I.J.N. (Pineapple) min	max	Flag	Reference Range	Flag
ethanol	<10	mg/L	10	-	3000		<10	
lactic acid	252	mg/L	30	-	500		<30	
5-hydroxymethylfurfural	<5	mg/L	5	-	20		<5	
glucose	26.0	g/L	0.1	15.0	40.0		17.0	
fructose	24.9	g/L	0.1	15.0	40.0		16.6	
glucose/fructose ratio**	1.04	-	-	0.80	1.25		0.77	
sucrose	44.8	g/L	0.1	25.0	80.0		32.5	
% sucrose**	47	%	1	-	-		35	
total sugar**	95.7	g/L	2.0	-	-		88.3	
alanine	43	mg/L	5	25	150		28	
acetoine	<10	mg/L	10	-	-		<10	
benzaldehyde	<5	mg/L	5	-	-		<5 mg/L in reference set	
benzoic acid	<10	mg/L	10	-	-		<10 mg/L in reference set	
methanol	<20	mg/L	20	-	-		<20	
sorbic acid	<10	mg/L	10	-	-		<10 mg/L in reference set	

Figure 2: Example of results for a Pineapple Juice from Philippines.Results comparison with the AIJN reference guidelines and with the values of the reference samples (in the database)



Analysis of declared Information

Type of Fruit: Pineapple

This model is based on 41757 samples, thereof 2637 samples of reference group *Pineapple*.

Result: Consistent with declared fruit type *Pineapple*. The probability of consistency is 100.0%.

Pineapple Other

Country of Origin: Philippines

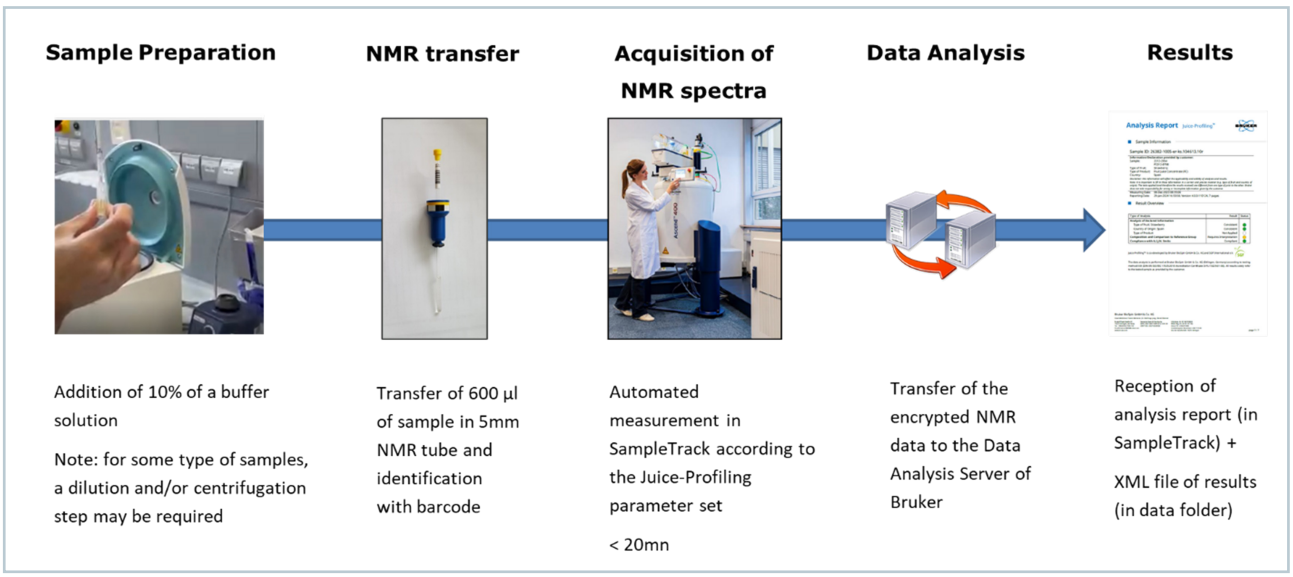
This model is based on 2148 samples, thereof 121 samples of reference group *Philippines*.

Result: Consistent with declared country *Philippines*. The probability of consistency is 100.0%.

Philippines Other

Figure 3: Example of verification of fruit type and country of origin

Workflow:



Testimonial Markus Jungen, SGF International e.V. about the Juice Profiling Solution

For a span of a decade, our collaborative efforts with Bruker have been pivotal in advancing the Juice-Profiling database. This noteworthy upgrade represents a significant stride in reinforcing the role of Nuclear Magnetic Resonance (NMR) as both an alternative and supplementary analytical technique, presenting a swift and comparatively cost-effective approach in the realm of juice analysis.

The Juice-Profiling methodology, a robust tool, not only expedites the evaluation of authenticity in fruit juices but also extends its reach to encompass vegetable juices. By harmonizing quantitative scrutiny of constituent elements and intricate statistical analyses of profiles, including provenance, this method offers a comprehensive and efficient means of discerning the authenticity of both fruit and vegetable juices.

Markus Jungen
Technical Manager, SGF International e.V.

Testimonial André Platzek, Tentamus Chelab GmbH, about the Juice Profiling Solution

The updated juice profiling method is a formidable tool for the authenticity analysis of fruit juices. It allows time-efficient and versatile scanning of a wide array of parameters helping us to meet our individual customer's needs. Simultaneous analysis of selected parameters provides a significant increase in efficiency with PCA analysis yielding valuable information on the authenticity of the fruit juices with special regard to purity and geographical origin of specific fruits.

André Platzek
Head of NMR Analytic Department, Tentamus Chelab G

Bruker BioSpin is continually improving its products and reserves the right to change specifications without notice. BS-BS-100181 08/2026 Bruker BioSpin.

Bruker BioSpin
info@bruker.com

bruker.com

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