INTERNATIONAL STANDARD 2173

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Fruit and vegetable products — Determination of soluble solids content — Refractometric method

Produits dérivés des fruits et légumes — Détermination du résidu sec soluble — Méthode réfractométrique

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FOREWORD

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

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It has been approved by the member bodies of the following countries :

Australia	India	Portugal
Austria	Iran	Romania
Bulgaria	Ireland	South Africa, Rep. of
Canada	Israel	Spain
Czechoslovakia	Kenya	Turkey
France	Mexico	United Kingdom
Germany, F.R.	Netherlands	U.S.A.
Ghana	New Zealand	Yugoslavia
Hungary	Poland	

No member body expressed disapproval of the document.

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Fruit and vegetable products — Determination of soluble solids content — Refractometric method

1 SCOPE

This International Standard specifies a refractometric method for the determination of the soluble solids content of fruit and vegetable products.

2 FIELD OF APPLICATION

This method is particularly applicable to thick products, to products containing suspended matter and to products rich in sugars[1]. If the products contain other dissolved substances, the results will be only approximate; nevertheless, for convenience the result obtained by this method may be considered conventionally as the soluble solids content.

3 DEFINITION

For the purpose of this International Standard, the following definition applies :

soluble solids content determined by the refractometric method : The concentration of sucrose in an aqueous solution which has the same refractive index as the product analysed, in specified conditions of preparation and temperature. This concentration is expressed as a percentage by mass.

4 PRINCIPLE

Measurement of the refractive index of a test solution at 20 °C, using a refractometer, and use of tables correlating refractive index with soluble solids content (expressed as sucrose), or direct reading of the soluble solids content on the refractometer.

5 APPARATUS

Usual laboratory apparatus, and in particular :

5.1 Refractometer indicating the refractive index by means of a scale graduated in 0,001, in order to allow readings to be estimated to 0,000 2.

This refractometer shall be adjusted so that at 20 °C it registers for distilled water a refractive index of 1,333 0.

or

5.2 Refractometer indicating the percentage by mass of sucrose by means of scale graduated in 0,50 %, in order to allow readings to be estimated to 0,25 %.

This refractometer shall be adjusted so that at 20 °C it registers for distilled water a soluble solids (sucrose) content of zero.

5.3 Means for circulating water to maintain the temperature of the prisms of the refractometer (5.1 or 5.2) constant to within ± 0,5 °C, in the neighbourhood of 20 °C, which is the reference temperature (see 7.1).

5.4 Beaker, capacity 250 ml.

6 PROCEDURE

6.1 Preparation of test solution

6.1.1 *Clear liquid products*

Thoroughly mix the laboratory sample and use it directly for the determination.

6.1.2 *Semi-thick products* (purées, etc.)

Thoroughly mix the laboratory sample. Press a part of the sample through a gauze folded in four, rejecting the first drops of the liquid and reserving the remainder of the liquid for the determination.

1) For the determination of the soluble solids content of fruit juices (not containing suspended matter) and of concentrated juices (clarified), the pyknometric method specified in ISO 2172 (at present at the stage of draft) should be applied.

6.1.3 *Thick products* (jams, jellies, etc.)

6.1.3.1 Weigh into the tared beaker (5.4), to the nearest 0,01 g, a suitable quantity (up to 40 g) of the laboratory sample and add 100 to 150 ml of distilled water. Heat the contents of the beaker to boiling and allow to boil gently for 2 to 3 min, stirring with a glass rod. Cool the contents and mix thoroughly.

6.1.3.2 After 20 min, weigh to the nearest 0,01 g, then filter through a fluted filter or a Buchner funnel into a dry vessel. Reserve the filtrate for the determination.

6.1.4 *Frozen products*

After thawing the sample and removing, if necessary, stones, pips and hard seed-cavity walls, mix the product with the liquid formed during the thawing process and proceed as described in 6.1.2 or 6.1.3 as appropriate.

6.1.5 *Dried products*

6.1.5.1 Cut a part of the laboratory sample into small pieces, remove, if necessary, stones, pips and hard seed-cavity walls, and mix carefully. Then weigh into a tared beaker, to the nearest 0,01 g, 10 to 20 g of the sample, add 5 to 10 times this mass of distilled water and place on a boiling water bath for 30 min, stirring from time to time with a glass rod. (If necessary, prolong the heating time until a homogeneous mixture is obtained.) Cool the contents of the beaker and mix well.

6.1.5.2 After 20 min, weigh to the nearest 0,01 g, then filter into a dry vessel. Reserve the filtrate for the determination.

6.2 Determination

Adjust the water circulation (5.3) in order to operate at the required temperature (between 15 and 25 °C) and allow it to flow to bring the prisms of the refractometer (5.1 or 5.2) to the same temperature, which shall remain constant to within ± 0,5 °C during the determination.

Bring the test solution (6.1) to the measuring temperature. Put a small quantity of test solution (2 or 3 drops are sufficient) on the fixed prism of the refractometer (5.1 or 5.2) and immediately adjust the movable prism. Suitably illuminate the field of view. The use of a sodium vapour lamp allows more precise results to be obtained (especially in the case of coloured and dark products).

Bring the line dividing the light and dark parts of the surface in the field of view to the crossing of the threads and read the value of the refractive index or the percentage by mass of sucrose, according to the instrument used (5.1 or 5.2).

6.3 Number of determinations

Carry out two determinations on the same laboratory sample.

7 EXPRESSION OF RESULTS

7.1 Corrections

If the determination has been carried out at a temperature other than 20 ± 0,5 °C, the following corrections are required :

a) *for the scale indicating the refractive index* (see 5.1), apply the formula

$$n_D^{20} = n_D^t + 0{,}000\ 13\ (t - 20)$$

where t is the temperature of measurement in degrees Celsius;

b) *for the scale indicating the percentage by mass of sucrose* (see 5.2), correct the result according to table 1.

7.2 Method of calculation and formula

The soluble solids content, expressed as a percentage by mass, is obtained as follows :

7.2.1 *Refractometer with refractive index scale*

Read from table 2 the percentage by mass of sucrose corresponding to the value read in accordance with 6.2, corrected if necessary in accordance with 7.1a). In the case of liquid or semi-thick products (6.1.1 or 6.1.2), the soluble solids content is equal to the number found. If the determination has been carried out on a diluted solution (6.1.3 or 6.1.5), the soluble solids content is equal to

$$\frac{P \times m_1}{m_0}$$

where

P is the percentage by mass of soluble solids in the diluted solution;

m_0 is the mass, in grams, of the sample before dilution (6.1.3.1 or 6.1.5.1);

m_1 is the mass, in grams, of the sample after dilution (6.1.3.2 or 6.1.5.2).

Take as the result the arithmetic mean of the two determinations, if the requirement of repeatability (see 7.3) is satisfied.

Express the result to one decimal place.

7.2.2 *Refractometer with sucrose scale*

In the case of liquid or semi-thick products (6.1.1 or 6.1.2), the soluble solids content, as a percentage by mass of sucrose, is equal to the value read in accordance with 6.2, corrected, if necessary, in accordance with 7.1b). If the determination has been carried out on a diluted solution (6.1.3 or 6.1.5), calculate the soluble solids content by means of the formula given in 7.2.1.

Take as the result the arithmetic mean of the two determinations, if the requirement of repeatability (see 7.3) is satisfied.

Express the result to one decimal place.

7.3 Repeatability

The difference between the results of two determinations carried out in rapid succession by the same analyst shall not exceed 0,5 g of soluble solids per 100 g of product.

8 TEST REPORT

The test report shall show the method used and the result obtained. It shall also mention any operational details not specified in this International Standard or regarded as optional, as well as any incidents which may have influenced the results.

The report shall give all information required for complete identification of the sample.

TABLE 1 — **Correction of readings of the refractometer with scale indicating sucrose for a temperature different from 20 ± 0,5 °C**

Temperature °C	Scale reading for soluble solids content, % (*m*/*m*)									
	5	10	15	20	25	30	40	50	60	70
	Corrections to be subtracted									
15	0,29	0,31	0,33	0,34	0,34	0,35	0,37	0,38	0,39	0,40
16	0,24	0,25	0,26	0,27	0,28	0,28	0,30	0,30	0,31	0,32
17	0,18	0,19	0,20	0,21	0,21	0,21	0,22	0,23	0,23	0,24
18	0,13	0,13	0,14	0,14	0,14	0,14	0,15	0,15	0,16	0,16
19	0,06	0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,08	0,08
	Corrections to be added									
21	0,07	0,07	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,08
22	0,13	0,14	0,14	0,15	0,15	0,15	0,15	0,16	0,16	0,16
23	0,20	0,21	0,22	0,22	0,23	0,23	0,23	0,24	0,24	0,24
24	0,27	0,28	0,29	0,30	0,30	0,31	0,31	0,31	0,32	0,32
25	0,35	0,36	0,37	0,38	0,38	0,39	0,40	0,40	0,40	0,40

TABLE 2 — **Refractive index and corresponding percentage by mass of soluble solids (sucrose)**

Refractive index	Soluble solids (sucrose) content	Refractive index	Soluble solids (sucrose) content	Refractive index	Soluble solids (sucrose) content	Refractive index	Soluble solids (sucrose) content
n_D^{20}	% (*m*/*m*)	n_D^{20}	% (*m*/*m*)	n_D^{20}	% (*m*/*m*)	n_D^{20}	% (*m*/*m*)
1,333 0	0	1,367 2	22	1,407 6	44	1,455 8	66
1,334 4	1	1,368 9	23	1,409 6	45	1,458 2	67
1,335 9	2	1,370 6	24			1,460 6	68
1,337 3	3	1,372 3	25	1,411 7	46	1,463 0	69
1,338 8	4			1,413 7	47	1,465 4	70
1,340 3	5	1,374 0	26	1,415 8	48		
		1,375 8	27	1,417 9	49	1,467 9	71
1,341 8	6	1,377 5	28	1,420 1	50	1,470 3	72
1,343 3	7	1,379 3	29			1,472 8	73
1,344 8	8	1,381 1	30	1,422 2	51	1,475 3	74
1,346 3	9			1,424 3	52	1,477 8	75
1,347 8	10	1,382 9	31	1,426 5	53		
		1,384 7	32	1,428 6	54	1,480 3	76
1,349 4	11	1,386 5	33	1,430 8	55	1,482 9	77
1,350 9	12	1,388 3	34			1,485 4	78
1,352 5	13	1,390 2	35	1,433 0	56	1,488 0	79
1,354 1	14			1,435 2	57	1,490 6	80
1,355 7	15	1,392 0	36	1,437 4	58		
		1,393 9	37	1,439 7	59	1,493 3	81
1,357 3	16	1,395 8	38	1,441 9	60	1,495 9	82
1,358 9	17	1,397 8	39			1,498 5	83
1,360 5	18	1,399 7	40	1,444 2	61	1,501 2	84
1,362 2	19			1,446 5	62	1,503 9	85
1,363 8	20	1,401 6	41	1,448 8	63		
		1,403 6	42	1,451 1	64		
1,365 5	21	1,405 6	43	1,453 5	65		

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