

# ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

## ISO RECOMMENDATION R 712

CEREALS AND CEREAL PRODUCTS

DETERMINATION OF MOISTURE CONTENT

(Routine method)

---

1st EDITION

April 1968

COPYRIGHT RESERVED

The copyright of ISO Recommendations and ISO Standards belongs to ISO Member Bodies. Reproduction of these documents, in any country, may be authorized therefore only by the national standards organization of that country, being a member of ISO.

For each individual country the only valid standard is the national standard of that country.

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

## BRIEF HISTORY

The ISO Recommendation R 712, *Cereals and cereal products – Determination of moisture content. (Routine method)*, was drawn up by Technical Committee ISO/TC 34, *Agricultural food products*, the Secretariat of which is held by the Magyar Szabványügyi Hivatal (MSZH).

Work on this question by the Technical Committee began in 1963 and led, in 1965, to the adoption of a Draft ISO Recommendation.

In March 1966, this Draft ISO Recommendation (No. 909) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Hungary	Romania
Belgium	India	South Africa,
Bulgaria	Iran	Rep. of
Chile	Israel	U.A.R.
Colombia	Netherlands	United Kingdom
Czechoslovakia	New Zealand	U.S.S.R.
Finland	Normay	Yugoslavia
France	Poland	
Germany	Portugal	

One Member Body opposed the approval of the Draft :

Ireland

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council which decided, in April 1968, to accept it as an ISO RECOMMENDATION.

## CEREALS AND CEREAL PRODUCTS

## DETERMINATION OF MOISTURE CONTENT

(Routine method)

## 1. SCOPE

1.1 This ISO Recommendation describes a routine method for the determination of the moisture content of cereals and cereal products. \*

## 1.2 Field of application

This method is applicable in particular to wheat, rice (dehulled paddy) and barley, in the state of grain, milled grain, semolina and flour.

The results are not regarded as satisfactory if the method is applied to malting barley.

NOTE. — For simplicity, in the following sections the term *product* is used to designate either a cereal or a cereal product.

## 2. DEFINITION

The *moisture content* is defined as the loss in mass, expressed as a percentage of the mass of the original sample, undergone by the product under the conditions specified in this ISO Recommendation.

## 3. PRINCIPLE

Determination of the loss in mass of the test portion by drying at a temperature of 130 to 133 °C, under strictly defined conditions which enable a result to be obtained in agreement with the result obtained by the basic reference method (ISO Recommendation R 711, *Cereals and cereal products — Determination of moisture content (Basic reference method)*).

## 4. APPARATUS

4.1 *Analytical balance.*

\* This ISO Recommendation does not override methods prescribed by recognized trade associations for use in contracts under their auspices.

#### 4.2 Grinding mill

- made of material which does not absorb moisture,
- easy to clean and having as little dead space as possible,
- enabling grinding to be carried out rapidly and uniformly, without appreciable development of heat and, as far as possible, without contact with the outside air,
- adjustable so as to obtain particles of dimensions indicated in clause 5.1.1.

4.3 *Dish* of non-corrodible metal or, failing this, of glass, with a sufficiently tight-fitting lid, the effective surface enabling the test portion to be distributed so as to give not more than 0.3 g/cm<sup>2</sup>.

4.4 *Constant-temperature oven*, electrically heated, controlled in such a way that the temperature of the air and of the shelves carrying the test portions is within the range 130 to 133 °C, in the neighbourhood of the test portions, in normal working.

The oven should have a heat capacity such that, when initially adjusted to a temperature of 131 °C, it can again reach this temperature in less than 45 minutes (preferably in less than 30 minutes) after inserting the maximum number of test portions that can be dried simultaneously.

The effectiveness of the ventilation is determined by means of *durum* wheat semolina, with a maximum particle size of 1 mm, as the test substance. The ventilation should be such that when all the test portions that the oven can hold are dried simultaneously at a temperature of 130 to 133 °C, the results after heating periods of 2 hours and 3 hours will not differ by more than 0.15 g of moisture per 100 g of sample.

4.5 *Desiccator*, with a thick perforated plate of metal or, failing this, of porcelain, containing pure phosphorus pentoxide (P<sub>2</sub>O<sub>5</sub>) of analytical grade or anhydrous calcium sulphate (CaSO<sub>4</sub>) granulated and impregnated with cobalt chloride as indicator, or any other effective desiccant.

### 5. PROCEDURE

Carry out weighings to the nearest 0.0001 g.

#### 5.1 Preparation of sample

##### 5.1.1 Products not requiring to be ground

Products having particles of sizes below or equal to 1.7 mm, less than 10 % by mass being over 1 mm and more than 50 % by mass being less than 0.5 mm, do not need to be ground before the determination.

### 5.1.2 *Products requiring to be ground*

If the sample does not comply with the particle size characteristics mentioned above, it requires to be ground either with or without pre-conditioning.

#### 5.1.2.1 GRINDING WITHOUT PRE-CONDITIONING

This applies to products which are not likely to undergo variations in moisture content in the course of grinding; in general, grains with a moisture content between 7 and 17 %.

Adjust the grinding mill (4.2) to obtain particles of the dimensions indicated in clause 5.1.1, grind a small quantity of the product and reject this.

Then quickly grind an amount of sample slightly greater than that required for the test, which should be at least 5 g.

Transfer the grindings to the previously dried and tared dish (4.3); quickly close the latter, and weigh it. Then carry out the determination.

The time between taking the sample and weighing before drying should be less than 2 minutes, if a small mill of the classical cone hammer type is used.

#### 5.1.2.2 GRINDING WITH PRE-CONDITIONING

Products which are too dry (moisture content less than 7 %) or too moist (moisture content more than 17 %) need to be suitably humidified or pre-dried before they are ground.

For products with moisture content below 7 %, re-humidify the sample by placing it in a suitable atmosphere so as to bring the moisture content to between 7 and 17 % (preferably between 9 and 15 %).

More frequently, it is necessary to pre-dry the grain, this being generally done when the moisture content is more than 17 %, in order to bring it within the range of 7 to 17 % (preferably between 9 and 15 %). Weigh a portion of the sample ( $M_0$ ) slightly greater than that required for the test and carry out the operation according to the instructions in clause 5.3, except that the time of heating in the oven (4.4) is 7 to 10 minutes, and the cooling of the product to laboratory temperature is done with the vessel uncovered and without a desiccator, for at least 2 hours.

Reweigh the sample after conditioning ( $M_1$ ) and immediately grind it in the mill (4.2) previously adjusted. Transfer the grindings to the dish (4.3). Reweigh ( $M_2$ ), ensuring that less than 2 minutes elapses between the two weighings ( $M_1$  and  $M_2$ ). Then carry out the determination.

## 5.2 Test portion

5.2.1 For products not requiring to be ground (see clause 5.1.1), carry out the following operations rapidly :

- introduce at least 5 g of the substance into the dish (4.3), which has been tared after being left for a time in the oven, (4.4) and cooled to laboratory temperature in the desiccator (4.5),
- close the dish (4.3) and weigh it.

5.2.2 For products requiring to be ground (see clause 5.1.2), use as the test portion the grindings in the dish (4.3) after the latter is closed and weighed (see clauses 5.1.2.1 or 5.1.2.2).

## 5.3 Determination

Place the open dish (4.3), containing the test portion, in the oven (4.4) and leave it for 2 hours (90 minutes for flours), reckoned from the moment when the oven temperature again reaches 130 °C.

After this period, and carrying out the operation rapidly, take the dish out of the oven, cover it and put it in the desiccator (4.5); never put dishes on the top of one another in the desiccator.

Weigh the dish when it has cooled to laboratory temperature (generally between 30 and 45 minutes after it is put into the desiccator).

Carry out at least two determinations on the same sample.

## 6. EXPRESSION OF RESULTS

### 6.1 Method of calculation and formula

The moisture content, as a percentage by mass of the product as received is equal to

- *without preliminary conditioning*

$$(M_0 - M_3) \times \frac{100}{M_0}$$

- *with preliminary conditioning*

$$\left[ (M_2 - M_3) \times \frac{M_1}{M_2} + M_0 - M_1 \right] \times \frac{100}{M_0} = 100 \left( 1 - \frac{M_1 \times M_3}{M_0 \times M_2} \right)$$

where

- $M_0$  is the initial mass, in grammes, of the test portion;
- $M_1$  is the mass, in grammes, of the test portion after conditioning;
- $M_2$  is the mass, in grammes, of the test portion after grinding;
- $M_3$  is the mass, in grammes, of the dry test portion.

Take as the result the arithmetic mean of the determination, if the requirement of clause 6.2 is satisfied.

Round the result to the nearest 0.05 g of moisture per 100 g of sample.

#### 6.2 Repetability

The difference between two determinations carried out simultaneously or in rapid succession by the same analyst should not exceed 0.1 g of moisture per 100 g of sample. If it does so, the determination should be repeated in duplicate.

#### 6.3 Remark

In comparison with those of the basic reference method, the results generally differ by less than 0.15 g per 100 g of sample.

### 7. NOTES ON PROCEDURE

- 7.1 The range of moisture content given for conditioning cereal grains before grinding corresponds approximately to a laboratory atmosphere at 20 °C and 40 to 70 % relative humidity. It would be reasonable to modify it for different atmospheric conditions.
- 7.2 Never place together, in the oven moist products and nearly dry samples, as this will result in partial rehydration of the latter.

### 8. TEST REPORT

The test report should show the method used and the result obtained. It should mention all operating details not specified in this ISO Recommendation, or regarded as optional, as well as any circumstances that may have influenced the result.

The report should include all details required for the complete identification of the sample.