# International Standard 7304

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# Durum wheat semolinas and alimentary pasta — Estimation of cooking quality of spaghetti by sensory analysis

*Semoules de blé dur et pâtes alimentaires — Appréciation de la qualité culinaire des spaghetti par analyse sensorielle*

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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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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# Durum wheat semolinas and alimentary pasta — Estimation of cooking quality of spaghetti by sensory analysis

## 1 Scope and field of application

This International Standard specifies a method for the estimation, by sensory analysis, of the cooking quality of alimentary pasta in the form of spaghetti, expressed by the surface condition and firmness characteristics.

The method applies only to the estimation of the cooking quality of spaghetti. This type of product is specified, because its geometrical shape is that which best illustrates the qualities obtained from a specific industrial or experimental durum wheat semolina.

NOTE — This method may also be applied to spaghetti made of common wheat or a mixture of common wheat and durum wheat, as long as the appropriate national regulations allow these products to be used in alimentary pasta.

In particular, this method has been elaborated to establish a reference against which the results obtained by instrumental or practical methods of sensory analysis can be compared, with a view to perfecting, accepting or checking such methods.

## 2 References

ISO 4120, *Sensory analysis — Methodology — Triangular test.*

ISO 5492, *Sensory analysis — Vocabulary.*

## 3 Definitions

For the purpose of this International Standard, the definitions of the various parts of ISO 5492, and the following, apply.

**3.1 surface condition** : Condition of superficial disintegration of cooked pasta. It can be assessed visually using reference photographs.

**3.2 firmness** : Resistance to cutting between the teeth and to crushing between the tongue and the palate.

## 4 Principle

Determination of a minimum cooking time and calculation of two experimental cooking times for each sample.

Sensory analysis of at most six samples presented in pairs to a panel of at least six qualified assessors.

Classification and scoring of the samples according to their surface condition and firmness.

## 5 Reagents

Use only reagents of recognized analytical grade.

**5.1 Artificially hardened water,** prepared as follows.

Weigh 1,465 6 g of anhydrous calcium oxide and 0,297 4 g of magnesium oxide, then put them in suspension in 10 l of distilled or deionized water.

Bubble through carbon dioxide, previously washed by passing through distilled water, from a Kipp's apparatus or a cylinder under pressure, until complete dissolution of the calcium and magnesium oxides (see figure 1). The dissolution of the oxides is very slow and requires 10 days of bubbling. If the solution is not clear after 10 days, filter it.

Then check that the pH is about 6 and that the calcium and magnesium content (hardness of the water) is equal to 3,2 mmol/l of calcium carbonate.

NOTE — During cooking, excess carbon dioxide (unreacted) is eliminated and the pH stabilizes at about 8.

**5.2 Sodium chloride.**

## 6 Apparatus

**6.1 Pans,** thick bottomed, of diameter about 17 cm, and of capacity 2,5 l.

**6.2 Two electric heating devices,** equipped with a plate of diameter about 19 cm and output about 1 500 W. This output should, on the one hand, allow 2 l of water in a pan (6.1) to be brought from 20 to 100 °C in 10 to 14 min and, on the other hand, allow the water to be maintained at boiling point without further adjustment of the output.

**6.3 Crushing plate,** of transparent plastic, of thickness 3 mm, in conformity with figure 2.

**6.4 Sieve,** of aperture size 2 mm and approximately 20 cm in diameter.

**6.5 White plates,** identical, a sufficient number for the tests.

**6.6 Wooden spatula.**

**6.7 Plate-warmer**, or **oven**, to warm the plates to 40 to 50 °C.

**6.8 Trays** and **forks.**

**6.9 Reference photographs for determination of minimum cooking time** (see annex C).

**6.10 Reference photographs to establish the surface condition of cooked spaghetti** (see annex D).

## 7 Preparation of samples for sensory analysis

### 7.1 Minimum cooking time, $t$

#### 7.1.1 Definition

The minimum cooking time, $t$, is the time after which the continuous white line, visible at the centre of a piece of spaghetti during cooking, has disappeared, when the spaghetti is crushed using the crushing plate (6.3).

By convention, the white line is considered to have disappeared when it is visible only as a row of dots (see the reference photographs in annex C).

#### 7.1.2 Determination

**7.1.2.1** Place 2 l of artificially hardened water (5.1) in a pan (6.1), add 14 g of sodium chloride (5.2) and bring to the boil.

**7.1.2.2** Place 100 g of unbroken spaghetti in the boiling water and twist after softening to get the spaghetti into the pan without breaking it. Stir gently with the spatula (6.6) at the start of cooking. Do not cover the pan.

**7.1.2.3** Two minutes before the minimum cooking time, estimated previously according to the size of the spaghetti, remove a piece of spaghetti and crush it using the crushing plate (6.3).

**7.1.2.4** Repeat this operation every 30 s until the continuous white line, visible at the centre of the crushed piece, disappears, using the reference photographs (6.9) for guidance. Note the corresponding minimum cooking time, $t$.

### 7.2 Standard cooking

**7.2.1** Place 2 l of artificially hardened water (5.1) in a pan (6.1), add 14 g of sodium chloride (5.2) and bring to the boil.

**7.2.2** Place 100 g of unbroken spaghetti in the boiling water and twist after softening to get the spaghetti into the pan without breaking it. Stir gently with the spatula (6.6) at the start of cooking. Do not cover the pan.

**7.2.3** At time $t_1 = t + 1$ min, transfer the contents of the pan to the sieve (6.4) and allow to drain for 15 s, starting from the moment when all the cooked spaghetti is on the sieve, while shaking the sieve gently.

**7.2.4** Distribute the cooked spaghetti on to the plates (6.5), previously coded and warmed to 40 to 50 °C on the plate-warmer or in the oven (6.7). Each plate shall carry about 30 to 50 g of cooked pasta.

**7.2.5** Present a plate to each of the assessors no later than 1 min after drainage is completed.

### 7.3 Overcooking

NOTE — Overcooking allows the estimation of the cooking quality of the spaghetti when the standard cooking time is exceeded by a certain time which is fixed conventionally at 10 min.

Repeat all the operations specified in 7.2 using a cooking time of $t_2 = t + 11$ min.

This additional period of 11 min (with respect to the minimum cooking time) may be modified to take into account the diameter of the spaghetti; the period shall be stated in the test report.

## 8 Sensory analysis

### 8.1 General test conditions

**8.1.1** The tests shall be carried out in a room which is specially designed for sensory analyses.

**8.1.2** The panel shall consist of at least six qualified assessors, selected by means of a triangular test in accordance with ISO 4120, adapted for the estimation of spaghetti.

**8.1.3** Previous training shall be given to assessors in the estimation of firmness, using reference samples which have been cooked for the standard time and overcooked by various times in order to cover as wide a firmness range as possible.

**8.1.4** The questionnaire and the reference photographs shall be explained beforehand to each of the assessors, each of whom shall have a written guide.

**8.1.5** The samples shall be presented in pairs to each assessor. No assessor shall ever have more than two plates in front of him. At most six and at least four pastas shall be evaluated.

**8.1.6** The pairs shall be constituted in such a way that each pasta is presented with each of the others. There are, therefore, 10 combinations according to cooking time when there are five pastas to be evaluated and 15 combinations when there are six pastas.

The order of presentation of the pairs shall be determined by lots, as shall the right-hand — left-hand arrangement of the plates for each pair. Examples of arrangements for presentation are given in annex A for five pastas.

**8.1.7** Cooked and overcooked products shall never be presented in the same series.

**8.1.8** Tasting shall be carried out in the morning in artificial red or yellow light, presentations of one single series progressing regularly during the same morning.

### 8.2 Progress of the test

**8.2.1** Each assessor shall be presented simultaneously with two plates, each containing a coded pasta sample, on a tray (6.8). The two samples shall be placed on each tray in the same order (left-right) for all the assessors.

**8.2.2** Each assessor shall evaluate the surface condition of the pastas, comparing them with the reference photographs (6.10). He shall give a score, expressed as a whole number, from 1 (very stuck together) to 9 (completely separate), first to the left-hand plate, then to the right-hand plate. The scores increase with the quality of surface condition.

Each assessor shall then take a forkful of pasta which he shall evaluate for firmness by chewing it with all his teeth, starting with the pasta in the left-hand plate, then the pasta in the right-hand plate. He shall give a score, expressed as a whole number, from 1 (very tender) to 9 (very firm). The scores increase with increasing firmness. (See the example of a response form in annex B.)

**8.2.3** Each sample shall be given a score by the assessor within 2 min of the tray being placed in front of him.

## 9 Expression of results

Prepare two tables, one for the standard cooking time and the other for overcooking, with the scores given by each assessor to the pastas evaluated. Calculate the arithmetic means per sample and per assessor for each criterion.

The ranking of the samples is established from the total scores, checking the classification by a statistical significance test (for example Kramer's quick range test[1]) or by an analysis of variance by rank (Friedman's test[2]) or by an analysis of variance by score (Fischer-Snedecor test).

## 10 Test report

The test report shall include the following information :

a) reference to this International Standard;

b) all the information necessary for the complete identification of the samples and in particular the diameter of the uncooked pieces of spaghetti measured using a micrometer calliper;

c) the number of samples examined and a statement that firmness and surface condition were the only criteria studied;

d) the number of qualified assessors employed and the date of their qualification — date of the last "selection of assessors" in accordance with ISO 4120;

e) the minimum cooking time, the standard cooking time and the overcooking time; underlining this if it is different from the standard cooking time plus 10 min;

f) any other recommendations given during the test;

g) the two tables of results with the arithmetic means and the classification table obtained after application of the Kramer quick range test;

h) date, hour and material conditions of the test;

j) name of the person supervising the tests.



[1] KRAMER, A. A quick range test for significance of difference in multiple comparisons. *Food Technology* November 1960 : 576-581.

[2] FRIEDMAN, M. The use of ranks to avoid the assumption of normality implicit in analysis of variance. *J. Am. Stat. Assoc.* **32** 1937 : 675-701.

# Annex A

## Examples of arrangements for presentation of samples

The following constitute examples of arrangements for presentation of samples, when 5 pastas, coded A, B, C, D and E, are to be evaluated after determining by lots the order of presentation of the pairs and the arrangement of the plates on the tray (the first letter represents the left-hand plate and the second the right-hand plate).

| Order of presentation | First example | Second example | Third example |
|---|---|---|---|
| 1 | AB | AE | CA |
| 2 | CD | CB | CD |
| 3 | EA | AC | EB |
| 4 | BC | DE | BC |
| 5 | DE | DC | ED |
| 6 | CA | AD | BD |
| 7 | DB | EC | AD |
| 8 | CE | BA | CE |
| 9 | DA | DB | EA |
| 10 | EB | BE | BA |

# Annex B

## Example of response form

Test No.: Date :

Name of assessor :

| Order | Scores given to the pastas (1 to 9) | | | |
|---|---|---|---|---|
| | Surface condition | | Firmness | |
| | Left | Right | Left | Right |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| *n* | | | | |

# Annex C

## Reference photographs for determining minimum cooking time