TC 34

International Standard ISO 6648

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Rice — Evaluation of cooking behaviour using a viscoelastograph

Riz — Évaluation du comportement au cours de la cuisson au moyen du viscoélastographe

First edition — 1985-08-15

UDC 633.18 : 620.16 : 641.73 **Ref. No. ISO 6648-1985 (E)**

Descriptors : agricultural products, grains (food), rice, tests, cooking tests.

Price based on 3 pages

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

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.

International Standard ISO 6648 was prepared by Technical Committee ISO/TC 34, *Agricultural food products.*

Rice — Evaluation of cooking behaviour using a viscoelastograph

1 Scope

This International Standard specifies a method of evaluating the cooking behaviour of rice by the determination of certain viscoelastic properties of the rice after cooking, i.e. swelling, firmness, elastic recovery and viscoelastic index, by means of a viscoelastograph. It also permits the determination of the quantity of water absorbed by the cooked rice (coefficient of water absorption).

2 Field of application

This International Standard is applicable to all whole-grain rice, i.e. husked rice and milled rice, whether it has been subjected to other technological treatments (such as precooking or parboiling) or not.

3 Definitions

For the purpose of this International Standard, the following definitions apply.

3.1 coefficient of water absorption: The ratio of the mass of rice after cooking to the mass of the same rice before cooking.

3.2 swelling: The thickness of grains of rice after cooking.

NOTE — Swelling is in reality the increase in volume of the rice during cooking. It can be measured by the increase in thickness of the grain, by determining the thickness of the rice before cooking and after cooking in the same manner. This thickness, measured after various cooking times, is sufficient to obtain a curve indicating the course of swelling.

3.3 firmness: The resistance of grains of cooked rice to crushing when subjected to stress.

3.4 elastic recovery: The tendency of grains of cooked rice to return to their initial form once the stress to which they have been subjected is released.

3.5 viscoelastic index: Ratio of the value of elastic recovery to the difference between the value for firmness and 100.

4 Principle

Cooking whole grains of rice in boiling distilled water. Weighing the cooked grains in order to establish the coefficient of water absorption, then determination, by means of a viscoelastograph, of the thickness of the grains of cooked rice, subjected for a given time to a constant force, which is then released. From these values, determination of the swelling, firmness, elastic recovery and viscoelastic index. Preparation of graphs giving these parameters as a function of cooking time.

5 Apparatus

5.1 Viscoelastograph or equivalent apparatus, equipped with a set of thickness gauges.

5.2 Thermostatically controlled bath, including a plate with holes to accommodate four or eight 250 ml beakers, and capable of attaining a temperature of 104 ± 1 °C.

5.3 Metal sieve, of aperture size 2 mm.

5.4 Flat tray, the base of which is covered by a sheet of sponge soaked in water.

5.5 Beakers, of capacity 250 ml.

5.6 Watch-glasses, of diameter 80 mm.

5.7 Petri dishes, of diameters 60 and 80 mm.

5.8 Timer.

5.9 Spatula.

5.10 Balance, accurate to 0,01 g.

6 Procedure

6.1 Preparation of beakers

Place the required number of beakers (5.5) in the thermostatically controlled bath (5.2) and fill them to the brim with distilled water and cover with watch-glasses (5.6), convex side down. Regulate the thermostatically controlled bath in such a way as to maintain the water in the beakers at boiling point with a heating system such that once a beaker has been uncovered for 30 s, boiling starts once again in less than 4 min, i.e. at approximately 104 °C.

6.2 Cooking

6.2.1 Carry out the following operations, adopting cooking times which cover the evolution of the rice from the beginning of cooking until it is overcooked. In general, these times are as follows :

for milled rice, from 10 to 35 min, with intervals of 5 min;

for husked rice and parboiled rice, from 10 to 45 min, with intervals of 5 min;

for pre-cooked rice, from 3 to 15 min, with intervals of 3 min.

The method is identical for all cooking times.

6.2.2 Place 1,5 g of the rice, weighed to the nearest 0,01 g, in one of the beakers filled with boiling water (see 6.1), cover immediately with a watch-glass, and start the timer (5.8).

Once the adopted cooking time has elapsed (see 6.2.1), remove the watch-glass and, wearing rubber gloves, remove the beaker and pour its contents into the sieve (5.3) which has previously been tared to the nearest 0,01 g. Drain by shaking for 15 s then weigh to the nearest 0,01 g.

Empty the contents of the sieve into a Petri dish (5.6) of 60 mm diameter, placed on the sheet of damp sponge in the flat tray (5.4). Separate the whole grains, removing those which are broken or which are damaged in the course of this operation. Cover the 60 mm dish with an 80 mm dish (5.6), so that the latter forms a sealed joint with the water saturating the sheet of sponge (see figure 1).

6.3 Adjustment of the viscoelastograph

Adjust the viscoelastograph according to the manufacturer's instructions, checking in particular the linearity of response for thickness between 0 and 3 mm using the thickness gauges.

Ballast the loading platform in such a way that the total mass placed on the samples is 700 g (take into account the mass of the loading platform given by the manufacturer).

Adjust the measurement cycle programme so that the mass of 700 g is applied for 40 s and that measurement continues for 20 s after the load has been removed.

6.4 Testing with the viscoelastograph (see figure 2)

Place three grains of rice in a triangular arrangement on the lower plate of the viscoelastograph approximately 1 h after the end of cooking.

Start the cycle and record the thickness δ_0 of the grains of rice before the load is applied, the thickness δ_1 after the load has been applied for 40 s and the thickness δ_2, 20 s after the load has been released.

Carry out six measurements for each cooking time.

7 Expression of results

7.1 Calculation and presentation

7.1.1 For each measurement, calculate

a) the firmness, F, by means of the formula

$$\frac{\delta_1}{\delta_0} \times 100$$

b) the elastic recovery, R, by means of the formula

$$\frac{\delta_2 - \delta_1}{\delta_0 - \delta_1} \times 100$$

where δ_0, δ_1 and δ_2 are the thicknesses, in millimetres, defined in 6.4.

7.1.2 For each cooking time calculate

a) the coefficient of water absorption from the formula

$$\frac{m}{m_0}$$

where

m is the mass, in grams, of rice after cooking and draining;

m_0 is the mass, in grams, of the rice before cooking;

b) the swelling, in millimetres: take the mean value $\overline{\delta_0}$ of the thickness measurements δ_0;

c) the firmness : take the mean value $\overline{F}$ of the values for firmness F;

d) the elastic recovery : take the mean value $\overline{R}$ of the values for elastic recovery R;

e) the viscoelastic index, I_q, from the formula

$$10 \times \frac{\overline{R}}{100 - \overline{F}}$$

7.1.3 Plot curves giving swelling, firmness, elastic recovery and viscoelastic index as functions of cooking time.