INTERNATIONAL STANDARD

ISO 6646

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Rice — Determination of the potential milling yield from paddy and from husked rice

Riz — Détermination des rendements d'usinage à partir du riz paddy et du riz décortiqué

Reference number
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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 6646 was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 4, *Cereals and pulses*.

This third edition cancels and replaces the second edition (ISO 6646:2000), which has been technically revised.

Introduction

The milling yields obtained from abrasive testing mills of the same model, although with differing adjustments, may vary more widely than those obtained from different types of abrasive testing mill.

This International Standard specifies a method for the determination of milling yield, to ensure that results obtained by different operators using abrasive test mills are comparable.

Rice — Determination of the potential milling yield from paddy and from husked rice

1 Scope

This International Standard specifies a laboratory method for the determination of the yield of husked rice obtained from paddy or parboiled paddy (*Oryza sativa* L.), and for the determination of the yield of milled head rice obtained from paddy or parboiled paddy, or from husked rice or husked parboiled rice.

This International Standard is only applicable to abrasive milling equipment.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 712, *Cereals and cereal products — Determination of moisture content — Reference method*

ISO 7301, *Rice — Specification*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7301 and the following apply.

3.1
husked rice yield
amount of husked rice obtained from paddy

3.2
milled rice yield
amount of milled rice (head rice, broken kernels, and chips) obtained from paddy or husked rice

3.3
milled head rice yield
amount of milled whole kernel and head rice obtained from paddy or husked rice

3.4
perfect kernel
husked or milled kernel without any broken part which is not immature or malformed

4 Principle

The husk is mechanically removed from paddy. The resultant husked rice is then weighed. Next, the bran and germ are mechanically removed from the husked rice to a fixed reduction in mass and the resulting milled head rice is weighed.

5 Apparatus

Usual laboratory apparatus and, in particular, the following.

5.1 Sample divider, conical sampler or multiple-slot sampler with distribution system.

5.2 Testing husker, suitable for removal of the husk from paddy without damaging the kernels.

5.3 Abrasive testing mill, suitable for removal of the pericarp and germ from husked rice.

5.4 Tweezers.

5.5 Small bowls.

5.6 Balance, capable of being read to the nearest 0,01 g.

6 Sampling

Sampling is not part of the method specified in this International Standard. A recommended sampling method is given in ISO 24333[1].

It is important the laboratory receive a truly representative sample which has not been damaged or changed during transport or storage.

7 Preparation of test sample

The laboratory sample shall have a mass of not less than 1,5 kg.

Carefully mix the laboratory sample to make it as homogeneous as possible, then reduce it through a sample divider (5.1) to obtain the test sample.

Determine the moisture content of the test sample in accordance with ISO 712. The acceptable range is a mass fraction of (13,0 ± 1,0) %.

If the moisture content is outside the acceptable range, the laboratory sample should be kept at ambient temperature and humidity for a sufficient period to obtain balanced moisture content within the specified range.

8 Procedure

8.1 Adjustment of equipment

8.1.1 Testing husker adjustment

Adjustment of the test equipment shall be carried out prior to the determination.

The testing husker (5.2) shall be considered correctly adjusted when, subsequent to dehusking of rice samples with grain dimensions similar to those of the laboratory sample, the following are not present:

a) husked rice with damage to the pericarp;

b) grains of paddy or husked rice in the separated husk;

c) husk particles in the husked rice.

8.1.2 Testing mill adjustment

Adjust the testing mill (5.3) by milling rice samples of grain dimensions similar to those of the laboratory sample in order to remove a mass fraction, ($f \pm 0{,}5$) %, of the husked rice so that the difference, D, between the mass of milled head rice (head rice includes whole kernels) and the mass of milled whole kernels is needed to meet the requirements as follows:

a) for grain with an average length of the test sample kernels ≤7,00 mm: $D \leq 3$ %;

b) for grain with an average length of the test sample kernels >7,00 mm: $D \leq 5$ %.

The value of f shall be agreed by the parties involved.

8.2 Determination of husked rice yield (see Figure A.1)

Take the test sample and divide it to give a portion suitable for the equipment. Pass through an aspiration apparatus to remove light matter, then spread the paddy and remove any extraneous matter. Weigh it to the nearest 0,01 g. A minimum of 200 g is recommended.

Dehusk the paddy in the testing husker (5.2). Any grains of paddy that are not dehusked shall be manually separated from the husked rice, and dehusked once more. Then the residual paddy shall be manually dehusked and added to the husked rice already present.

Weigh the total yield of husked rice to the nearest 0,01 g.

Carry out the test in duplicate.

8.3 Determination of milled head rice yield

8.3.1 Starting from paddy or parboiled paddy (see Figure A.2)

8.3.1.1 Proceed in accordance with 8.2 to obtain the husked rice.

Divide the husked rice to give a portion suitable for the equipment. Weigh and record the mass to the nearest 0,01 g. A minimum of 100 g is recommended.

8.3.1.2 Thoroughly clean the testing mill (5.3). Introduce the husked rice sample and mill it for the time necessary to remove the mass fraction ($f \pm 0{,}5$) % of its total mass. Predetermine the milling time by trials on each test sample.

Weigh the milled rice obtained and record the mass to the nearest 0,01 g.

Separate the head rice from the broken kernels and place the two fractions in separate bowls.

Weigh the head rice and record the mass to the nearest 0,01 g.

Carry out the test in duplicate.

8.3.2 Starting from husked rice or husked parboiled rice (see Figure A.3)

8.3.2.1 Take the test sample and divide it to give a portion suitable for the equipment. Pass through an aspiration apparatus to remove light matter, then spread the husked rice and remove any extraneous matter. Weigh it to the nearest 0,01 g. A minimum of 100 g is recommended.

8.3.2.2 Continue in accordance with the procedure specified in 8.3.1.2.

Carry out the test in duplicate.

9 Expression of results

Calculate the results as quotients to four decimal places according to Table 1.

Table 1 — Calculation of milling yields

Parameter	Mass, m, of test portion starting from[a]	
	Paddy	Husked rice
Husked rice, y_0	m_y/m_x	1
Milled rice, y_1	m_1/m_z	m_1/m_z
Milled head rice, y_2	m_2/m_z	m_2/m_z

[a] For variable definitions, refer to the procedure schemes in Figure A.1 or A.2 for paddy, and Figure A.3 for husked rice.

Express the yields as percentage mass fractions, with reference to the starting material, as follows:

Potential yield of husked rice, y_h

$$y_h = y_0 \times 100\ \%$$

Potential yield of milled rice, y_m

$$y_m = y_0 y_1 \times 100\ \%$$

Potential yield of milled head rice, y_{mh}

$$y_{mh} = y_0 y_2 \times 100\ \%$$

Calculate the results for each category to two decimal places, and report them to the nearest 0,1 %.

10 Precision

10.1 Interlaboratory test

Details of an interlaboratory test on the precision of the method are summarized for information in Annex B. The values derived from this interlaboratory test may not be applicable to concentration ranges and matrices other than those given.

10.2 Repeatability

The absolute difference between two independent single test results, obtained using the same method on identical test material in the same laboratory by the same operator using the same equipment within a short interval of time, will in not more than 5 % of cases be greater than the arithmetic mean of the values for the repeatability limit, r, from the interlaboratory study:

a) for husked rice, 1 %;

b) for milled head rice, 2 %.

10.3 Reproducibility

The absolute difference between two single test results, obtained using the same method on identical test material in different laboratories with different operators using different equipment, will in not more than 5 % of cases be greater than the arithmetic mean of the values for the repeatability limit, R, from the interlaboratory study:

a) for husked rice, 3 %;

b) for milled head rice, 5 %.

11 Test report

The test report shall contain at least the following information:

a) all information necessary for the complete identification of the sample;

b) the sampling method used, if known;

c) the test method used, with reference to this International Standard (ISO 6646:2011);

d) all operating details not specified in this International Standard, or regarded as optional, together with details of any incidents which may have influenced the test result(s);

e) the test result(s) obtained;

f) if the repeatability has been checked, the final quoted result obtained.

Annex A
(normative)

Procedure schemes

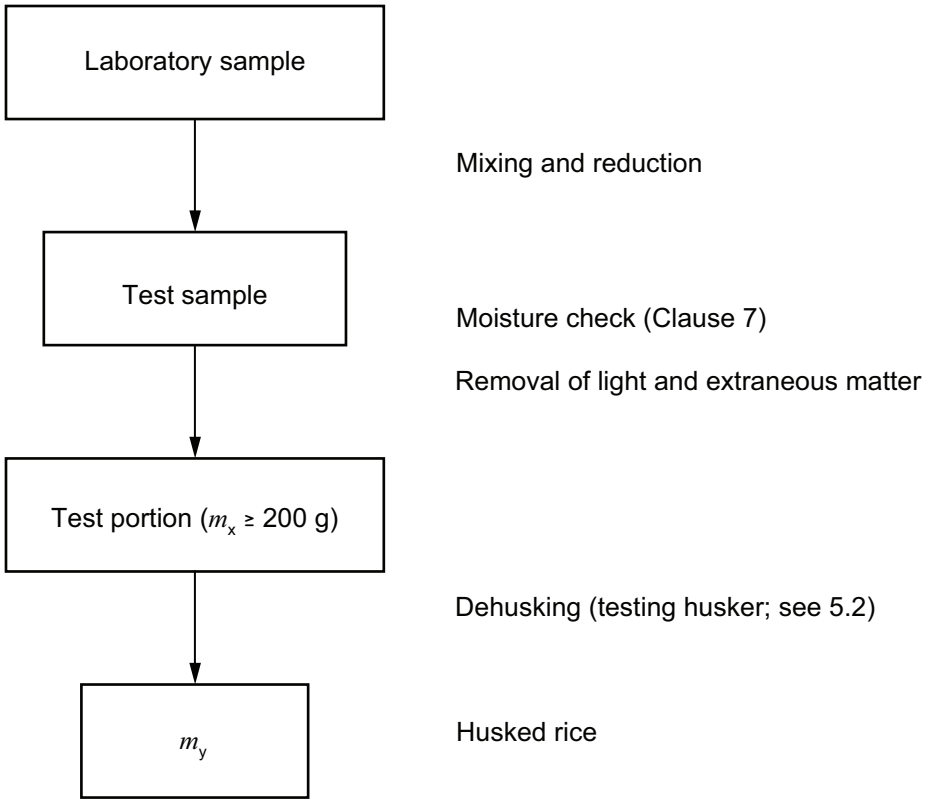

Figure A.1 — Starting from paddy or parboiled paddy: yield of husked rice

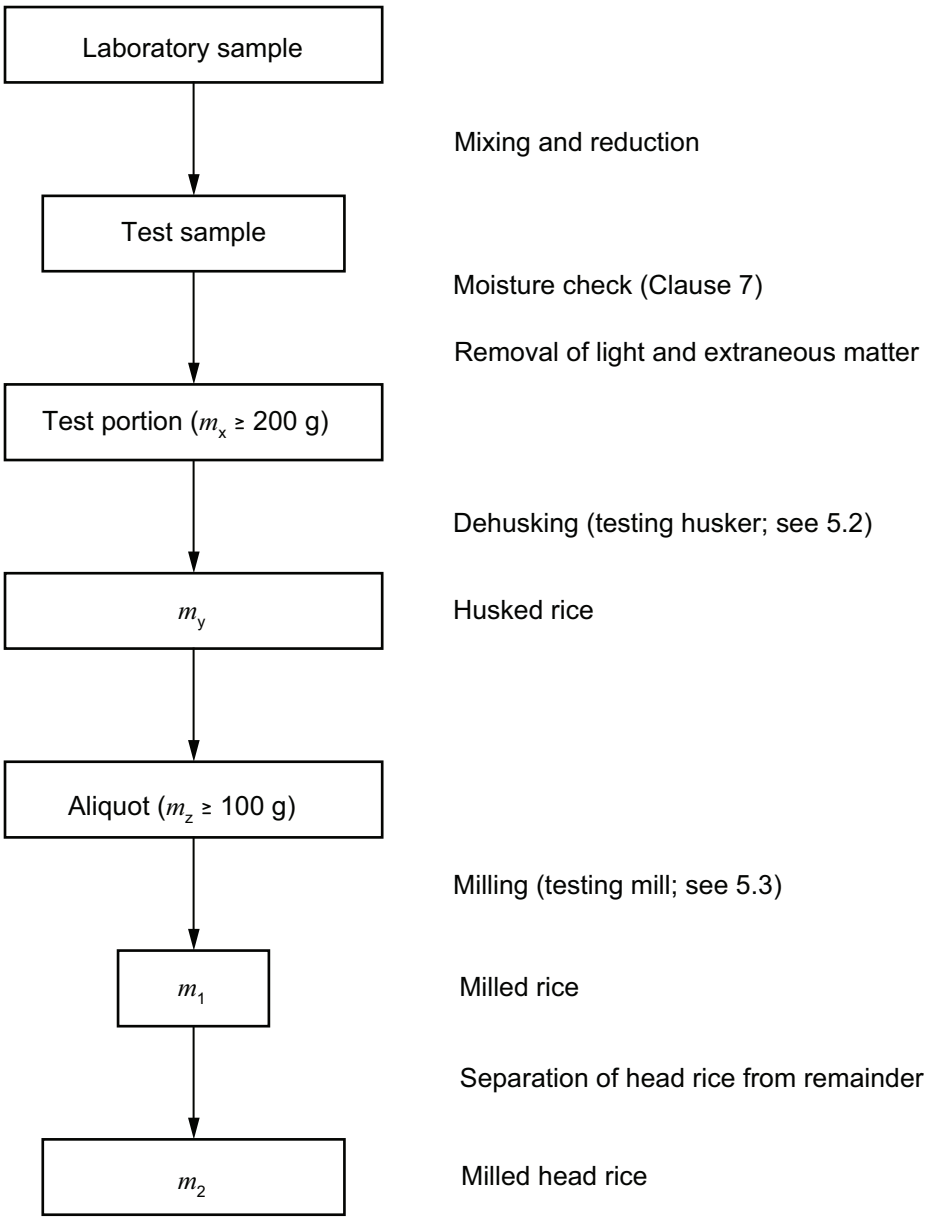

Figure A.2 — Starting from paddy or parboiled paddy: yield of husked rice, milled rice and milled head rice

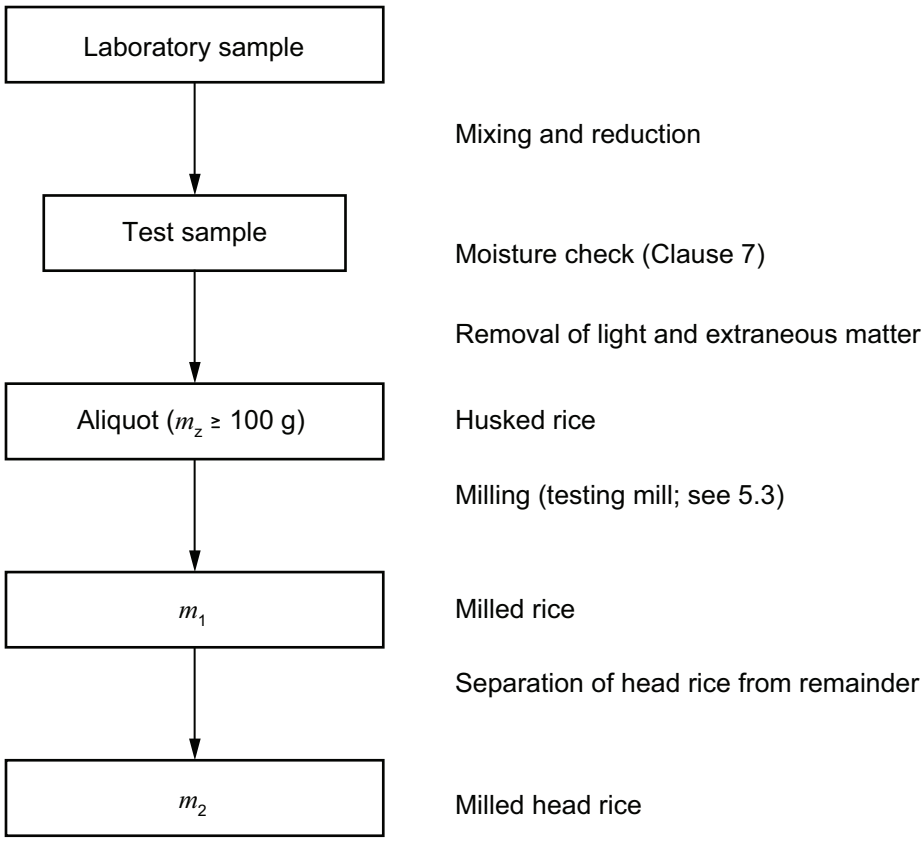

Figure A.3 — Starting from husked rice or husked parboiled rice: yield of milled rice and milled head rice

Annex B
(informative)

Results of an interlaboratory test

An interlaboratory study carried out by Henan University of Technology (China), with the participation of 10 laboratories, each of which carried out three determinations on seven different types of kernel, gave the statistical results, analysed in accordance with ISO 5725-1:1994[2] and ISO 5725-2:1994[3], shown in Tables B.1 and B.2.

The f value was 10 %.

Table B.1 — Repeatability and reproducibility of y_h

Parameter	Rice sample				
	GD	JX	HB	JS	LJ
Number of laboratories retained after eliminating outliers	9	9	9	9	8
Mean value, g/100 g	79,5	79,3	79,1	83,9	81,7
Standard deviation of repeatability, s_r, g/100 g	0,27	0,17	0,19	0,24	0,18
Coefficient of variation of repeatability, %	0,34	0,21	0,24	0,28	0,22
Repeatability limit, r ($r = 2{,}83\ s_r$)	0,75	0,48	0,53	0,67	0,52
Standard deviation of reproducibility, s_R, g/100 g	0,65	1,70	0,68	0,99	0,64
Coefficient of variation of reproducibility, %	0,82	2,15	0,86	1,18	0,78
Reproducibility limit, R ($R = 2{,}83\ s_R$)	1,85	4,82	1,92	2,81	1,80

Table B.2 — Repeatability and reproducibility of y_{mh}

Parameter	Rice sample						
	GD	TG[a]	JX	HB	JS	LJ	JX-ZG[b]
Number of laboratories retained after eliminating outliers	8	9	8	9	9	8	8
Mean value, g/100 g	65,0	80,1	49,5	60,0	71,2	67,3	86,6
Standard deviation of repeatability, s_r, g/100 g	0,31	0,91	0,82	0,45	0,59	0,61	0,38
Coefficient of variation of repeatability, %	0,47	1,14	1,65	0,75	0,82	0,91	0,44
Repeatability limit, r ($r = 2{,}83\ s_r$)	0,87	2,58	2,31	1,27	1,66	1,73	1,08
Standard deviation of reproducibility, s_R, g/100 g	1,23	2,46	4,79	1,89	1,88	1,69	1,54
Coefficient of variation of reproducibility, %	1,89	3,08	9,69	3,15	2,64	2,51	1,78
Reproducibility limit, R ($R = 2{,}83\ s_R$)	3,47	6,97	13,57	5,35	5,31	4,78	4,37

[a] Brown rice.

[b] Parboiled brown rice.

Bibliography

[1] ISO 24333, *Cereals and cereal products — Sampling*

[2] ISO 5725-1:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

[3] ISO 5725-2:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

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