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Agroprocessing machines— Test methods

Part 3: Rice mill

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In order to match with technological development and to keep continuous progress in industries, standards are subject to periodic review. Users shall ascertain that they are in possession of the latest edition

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Contents

Page

Foreword	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 General conditions for test and inspection	2
4.1 Role of manufacturer/dealer	2
4.2 Test site conditions	2
5 Suspension of test	2
6 Test preparation	2
6.1 Preparation of the rice mill for testing	2
6.2 Test materials	2
6.3 Running-in and preliminary adjustments	3
7 Pre-test observation	3
8 Performance test	3
8.1 Operation of the rice mill	3
9 Sampling	3
9.1 Data collection	3
9.1.1 Duration of test	3
9.1.2 Noise level	4
9.1.3 Speed of components	4
9.1.4 Energy consumption	4
9.1.5 Data recording and observations	4
10 Laboratory analysis	4
11 Formula	4
12 Test report	4
Annex A (normative) Test materials for rice mill	6
A.1 Sample characteristics	6
A.2 Quantity to be supplied	6
A.3 Sample preparation	6
Annex B (normative) Specification for rice mill	7
12.1 General information	7
Annex C (normative) Sampling and measurements for test material	<u>1142</u>
C.1 Sampling from different outlets	<u>1142</u>
C.2 Handling of samples	<u>1142</u>
C.3 Other measurements required during the test run	<u>1142</u>
C.4 Measurement of fuel/power consumption	12
C.4.1 For rice mill using engine as prime mover	12
C.4.2 Using electric motors as prime mover	<u>1243</u>

Annex D (normative) Performance test data sheet	14
Annex E (normative) Laboratory analysis.....	<u>1819</u>
E.1 Laboratory analysis of input paddy	<u>1819</u>
E.1.1 Purity	<u>1819</u>
E.1.2 Moisture content	<u>1819</u>
E.1.3 Cracked grains	<u>1819</u>
E.1.4 Weight per 1000 grains full grain test paddy	<u>1819</u>
E.1.5 Weight of 1000 grains whole head brown rice.....	<u>1920</u>
E.1.6 Milled rice grain parameters	<u>1920</u>
E.1.7 Weight of 1000-grain whole head milled rice	<u>1920</u>
E.1.8 Damaged grain	<u>1920</u>
E.2 E.2 Laboratory analysis of samples from test rice mill	<u>1920</u>
E.2.1 Weight of 1000 grains whole head brown rice.....	<u>1920</u>
E.2.2 Coefficient of hulling	<u>1920</u>
E.2.3 Coefficient of wholeness	<u>1920</u>
E.2.4 Weight of 1000 grains whole head milled rice	<u>1920</u>
E.2.5 Grain parameters	<u>2021</u>
E.2.6 Milling degree.....	<u>2021</u>
Annex F (normative) Laboratory analysis data sheet	<u>2122</u>
Annex G (normative) Formula used during calculations and testing	<u>2324</u>

Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

DRS 269-3 was prepared by Technical Committee RSB/TC 47, Steel, aluminium and related products.

In the preparation of this standard, reference was made to the following standard (s):

1) XYZ: Title

2) XYZ: Title

The assistance derived from the above source is hereby acknowledged with thanks.

This second edition cancels and replaces the first edition (RS 269-3:2015), which has been technically revised.

DRS269 consists of the following parts, under the general title *Agricultural machinery— Test methods*:

- Part 1: *Price thresher*
- Part 2: *Power operated maize sheller*
- Part 3: *Rice mill*
- Part 4: *Heated air mechanical grain dryer*
- Part 5: *Maize mill*

Committee membership

The following organizations were represented on the Technical Committee on *Steel, aluminium and related products* (RSB/TC 47) in the preparation of this standard.

University of Rwanda/college of science and technology

University of Rwanda/College of agriculture animal science and veterinary medicine

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Kabizu business group

Rwanda Polytechnic/IPRC Kigali

Rwanda Polytechnic/IPRC Ngoma

Rwanda Polytechnic/IPRC Musanze

RWANTECH Boilers

Rwanda Inspectorate and competition authority

Rwanda Institute for Conservation Agriculture

ACER Ltd

Rwanda Standards Board(RSB) – Secretariat

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Agroprocessing machines — Test methods — Part 3: Rice mill

1 Scope

This Draft Rwanda Standard specifies the methods of sampling, testing and inspection for rice mill.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

DRS 268-3, Agroprocessing machines — Specification — Part 3: Rice mill

RS 236, Acoustics- Noise pollution — Tolerance limit

3 Terms and definitions

For the purposes of this document, the terms and definitions given in RS 268-3 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

brewers rice

small pieces or particles of grains that pass through a sieve having round perforations 1.4 mm in diameter

3.2

regular milled rice

rice grain from which the hull, the germ, the outer bran layers and the greater part of the inner bran layers have been removed but part of the lengthwise streaks of the bran layers may still be present on 15 % to 40 % of the sample grains

3.3

Under-milled rice

rice grain from which the hull, the germ, the outer bran layer, and the greater part of the inner bran layer have been removed, but part of the lengthwise streaks of the bran layer may still be present on more than 40 % of the sample grains

3.4

well-milled rice

rice grain from which the hull, the germ, the outer bran layer, and the greater part of the inner bran layer have been removed, but part of the lengthwise streaks of the bran layer may still be present on less than 15 % of the sample grains.

4 General conditions for test and inspection

4.1 Role of manufacturer/dealer

The manufacturer/dealer shall comply with the test procedures of national testing authority.

4.2 Test site conditions

The rice mill shall be tested as installed for normal operation. The site shall have ample provisions for grain handling, temporary storage, and work space.

5 Suspension of test

5.1 If during the test run, the machine stops due to breakdown or malfunction so as to affect the machine's performance, the test may be suspended.

5.2 The decision to suspend or to continue the test is at the discretion of the test engineer and concurred by the representative.

6 Test preparation

6.1 Preparation of the rice mill for testing

6.1.1 A check shall be made by the manufacturer/client and testing authority that the rice mill has been assembled and installed in accordance with the instruction of the manufacturer.

6.1.2 The rice mill shall be cleaned adequately for the purpose of testing.

6.2 Test materials

The paddy to be used for testing shall be prepared in sufficient quantity following the procedure in Annex A.

6.3 Running-in and preliminary adjustments

6.3.1 Before the start of the test, the rice mill shall have undergone a breaking-in period.

6.3.2 The rice mill shall be operated at the test site for sufficient duration with and without load.

6.3.3 During the running-in period, the various adjustments of the rice mill shall be made according to the manufacturer's recommendations.

6.3.4 No other adjustments shall be permitted during the test.

7 Pre-test observation

The specifications claimed by the manufacturer and the physical details given in Annex B shall be verified by the recognized testing authority.

8 Performance test

8.1 Operation of the rice mill

8.1.1 The rice mill shall be operated at the manufacturer's recommended setting of its components.

8.1.2 The recommended feeding rate shall be maintained during the test run with a duration of at least 30 minutes.

8.1.3 For multi-pass rice mills with control tanks, these tanks shall be fully opened during the test runs.

8.1.4 After the test-run, the milling area shall be cleaned and then prepared for the next test trial(s).

8.1.5 This procedure shall be repeated for at least three test trial(s).

9 Sampling

Sampling procedure is given in Annex C.

9.1 Data collection

9.1.1 Duration of test

The duration of each test trial shall start with the feeding of the paddy into the intake hopper/intake pit and ends before bagging or at the start of feeding of milled rice to the bagging bin.

9.1.2 Noise level

9.1.2.1 The noise emitted by the machine, with or without load, shall be measured using a noise level meter both at the location of the operators and baggers.

9.1.2.2 The noise limit shall comply with the requirements specified in RS 236.

9.1.3 Speed of components

9.1.3.1 The speed of the rotating shafts of the rice mill's major components shall be taken using a tachometer.

9.1.3.2 Measurements shall be taken with and without load for sub-clause 9.1.2 and 9.1.2 as specified in Annex D.

9.1.4 Energy consumption

9.1.4.1 Before the start of each test trial, the fuel tank shall be filled to its capacity and after each test; the fuel consumed shall be measured.

9.1.4.2 In case an electric motor is used as a prime mover, a power meter shall be used to measure electric energy consumption.

9.1.5 Data recording and observations

Record sheet for all data and information during the test is given in Annex D. Observations to be taken during the performance test shall be recorded in this sheet.

10 Laboratory analysis

10.1 Laboratory analysis is carried out to analyze the grain samples taken during the performance test.

10.2 The laboratory procedures to be followed in the analysis are given in Annex E. Items to be determined shall be recorded in Annex F.

10.3 The quality of milled rice samples from the rice mill shall be compared to the quality of milled rice using the laboratory rubber roll husker/huller and a laboratory whitener.

11 Formula

The formulas to be used during calculations and testing are given in Annex G.

12 Test report

The test report shall include the following information:

- a) title;
- b) summary of results;
- c) purpose and scope of Test;
- d) methods of Test;
- e) conditions of the machine;
- f) description of the machine;
- g) results and discussions;
- h) observations (include pictures); and
- i) names and signatures of test engineers.

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Annex A (normative)

Test materials for rice mill

A.1 Sample characteristics

Test materials to be used shall have the following characteristics:

- A.1.1 Variety: locally grown (as much as possible single variety)
- A.1.2 Grain Moisture Content: dried to a uniform moisture content of 14 %
- A.1.3 Purity: 98 %, minimum
- A.1.4 Type: Long and slender grains

NOTE **long grains** –palay whose average length of the full brown rice grain is above 6.5 mm slender grains – palay with whole milled rice grain having length/width ratio over 3.0

A.2 Quantity to be supplied

- A.2.1 The amount of test material to be supplied shall be sufficient for at least 3h30 min of continuous milling operation for single pass rice mill.
- A.2.2 At least three test trials shall be conducted with minimum duration of 30 min per trial. The excess amount shall be used for running-in prior to the actual conduct of test trials.
- A.2.3 For test of multi-pass rice mill, the amount of test material to be supplied shall be sufficient for 5 h of continuous milling operation.
- A.2.4 At least three test trials shall be conducted with minimum duration of 2 h per trial.

A.3 Sample preparation

Prepare the sample in such a way that test sample to be used for the running-in and in each test trial shall have identical characteristics in terms of moisture content and variety

**Annex B
(normative)**

Specification for rice mill

Name of Applicant (Distributor): _____

Address: _____

Tel No: _____

Manufacturer Name : _____

Address: _____

Tel No: _____

Address: _____

12.1 General information

Serial No: _____ Brand/Model: _____

Type : _____ Make: _____

Production date of rice mill to be tested: _____

Testing agency : _____ Date of testing : _____

Location of test: _____ Test Engineer : _____

Table B 1 — Items to be inspected

Items	Manufacturer's Specifications	Verification by the Testing Authority
B.1 Main structure		
B.1.1 Overall dimensions (mm)		
B.1.1.1 Length		
B.1.1.2 Width		

B.1.1.3 Height		
B.1.2 Weight (kg), if applicable		
B.2 Prime mover		
B.2.1 Electric motor		
B.2.1.1 Brand		
B.2.1.2 Type		
B.2.1.3 Make or manufacturer		
B.2.1.4 Serial number		
B.2.1.5 Rated power (kW)		
B.2.1.6 Rated speed (rpm)		
B.2.1.7 Phase		
B.2.1.8 Voltage (V)		
B.2.1.9 Current (A)		
B.2.1.10 Frequency (Hz)		
B.2.2 Engine		
B.2.2.1 Brand		
B.2.2.2 Model		
B.2.2.3 Make or manufacturer		
B.2.2.4 Type		
B.2.2.5 Serial number		
B.2.2.6 Rated power (kW)		
B.2.2.7 Rated speed (rpm)		
B.2.2.8 Displacement (cm ³)		
B.2.2.9 Cooling system		
B.2.2.10 Starting system		
B.3 Intake hopper/Loading Pit		
B.3.1 Type		
B.3.2 Holding capacity (kg)		
B.3.3 Materials of construction		
B.3.4 Features		
B.4 Pre-cleaner		
B.4.1 Type		
B.4.2 Size		

B.4.3 Materials of construction		
B.5 Hulling unit		
B.5.1 Type		
B.5.2 Size		
B.5.3 Materials of construction		
b.5.4 Motor		
B.5.4.1 Rated power (kW)		
B.5.4.2 Rated speed (rpm)		
B.6 Paddy separator		
B.6.1 Type		
B.6.2 Number of trays/compartments		
B.6.3 Motor		
B.6.3.1 Rated power (kW)		
B.6.3.2 Rated speed (rpm)		
B.7 Destoner		
B.7.1 Type		
B.7.2 Motor		
B.7.2.1 Power (kW)		
B.7.2.2 Speed (rpm)		
B.8 Whitener		
B.8.1 Type		
B.8.2 Motor		
B.8.2.1 Power (kW)		
B.8.2.2 Speed (rpm)		
B.9 Polisher		
B.9.1 Type		
B.9.2 Motor		
B.9.2.1 Power (kW)		
B.9.2.2 Speed (rpm)		
B.10 Elevator(s)		
B.10.1 Type		
B.10.2 Number of units		
B.10.3 Size of buckets		

B.10.4 Motor		
B.10.4.1 Power (kW)		
B.10.4.2 Speed (rpm)		
B.11 Rice sifter		
B.11.1 Type		
B.11.2 Size		
B.11.3 Number of screens		
B.11.4 Size of perforations (mm)		
B.11.5 Material of construction		
B.12 Bagging bin		
B.12.1 Capacity (kg)		
B.12.2 Material of construction		
B.13 Safety devices		
B.14 Special features		

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Annex C (normative)

Sampling and measurements for test material

C.1 Sampling from different outlets

C.1.1 During each test trial three samples each shall be collected from the outlets of the different components (huller, paddy separator, destoner, whitener, etc.) of the rice mill to be analyzed in the laboratory.

C.1.2 The minimum amount of sample to be taken shall be twice as much as what is needed for a particular analysis.

C.1.3 The excess sample shall be used for reference purposes or for an eventual second check in case of review.

C.2 Handling of samples

C.2.1 All samples to be taken to the laboratory shall be placed in appropriate containers and properly labelled.

C.2.2 If the sample is to be used for determining moisture content, it must be kept in dry and airtight containers.

C.3 Other measurements required during the test run

C.3.1 Data shall be taken for the following:

- a) speed of rotating components; and
- b) noise level at operator's and bagger's location.

C.3.2 For each data to be taken, there shall be a minimum of five observations. These shall be taken with and without load.

C.3.3 Before taking of data, the feed rate, speed and other functional characteristics shall be stabilized.

C.3.4 The time of recording shall be properly spaced during the whole duration of the test trials.

C.4 Measurement of fuel/power consumption

C.4.1 For rice mill using engine as prime mover

C.4.1.1 The tank shall be filled to full capacity before the test.

C.4.1.2 After the test, fill the tank with measured fuel to the same level before the test.

C.4.1.3 When filling up the tank, careful attention shall be paid to keep the tank horizontal and not to leave empty space on the tank.

C.4.2 Using electric motors as prime mover

C.4.2.1 Use a power meter to measure the voltage, current, and the total electric power consumption of the rice mill.

C.4.2.2 There shall be three sets of data with a minimum of five observations per set taken with load and one set of data taken without load.

C.4.2.3 Data shall be taken simultaneous with the collection of samples for laboratory analysis.

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Annex D (normative)

Performance test data sheet

Test trial No.: _____ Test Engineers: _____

Assistants: _____ Test requested by: _____

Date: _____ Location: _____

Machine: _____ Manufacturer: _____

Table D 1 — Data sheet

ITEMS	Trial			
	1	2	3	Average
D.1 Conditions of crop				
D.1.1 Crop				
D.1.2 Source				
D.1.3 Variety				
D.1.4 Moisture content (%)				
D.2 Weight of input (kg)				
D.3 Input time (h)				
D.4 Input capacity (kg/h)				
D.5 Weight of milled rice (kg)				
D.6 Output time (h)				
D.7 Output capacity (kg/h)				
D.8 Milling time (h)				
D.9 Milling capacity (kg/h)				
D.10 Speed of components (rpm)				
D.10.1 Paddy cleaner				
D.10.1.1 Without load				
D.10.1.2 With load				
D.10.2 Paddy cleaner motor				
D.10.2.1 Without load				

D.10.2.2 With load				
D.10.3 Rubber roll (fixed)				
D.10.3.1 Without load				
D.10.3.2 With load				
D.10.4 Rubber roll (adjustable)				
D.10.4.1 Without load				
D.10.4.2 With load				
D.10.5 Rubber roll motor				
D.10.5.1 Without load				
D.10.5.2 With load				
D.10.6 Paddy separator				
D.10.6.1 Without load				
D.10.6.2 With load				
D.10.7 Abrasive whitener				
D.10.7.1 Without load				
D.10.7.2 With load				
D.10.8 Friction whitener				
D.10.8.1 Without load				
D.10.8.2 With load				
D.10.9 Rice Sifter				
D.10.9.1 Without load				
D.10.9.2 With load				
D.10.10 Main drive				
D.10.10.1 Without load				
D.10.10.2 With load				
D.11 Noise level, dB(A)				
D.11.1 Operator				
D.11.1.1 Without load				
D.11.1.2 With load				
D.11.2 Bagger				
D.11.2.1 Without load				
D.11.2.2 With load				

D.12 Power consumption				
D.12.1 Power (kW)				
D.12.1.1 Without load				
D.12.1.2 With load				
D.12.2 Current (A)				
D.12.2.1 Without load				
D.12.2.2 With load				
D.12.3 Voltage (V)				
D.12.3.1 Without load				
D.12.3.2 With load				
D.13 Fuel consumed (L)				
D.14 Fuel consumption (L/h)				

D.15 Other observations

D.15.1 Ease of loading

D.15.2 Ease of cleaning of parts

D.15.3 Ease of adjustments

D.15.4 Ease of collecting output

D.15.5 Safety

D.15.6 Labour requirements

D.15.7 Failure or abnormalities that may be observed on the rice mill or its components parts during and after the milling operation

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Annex E (normative)

Laboratory analysis

E.1 Laboratory analysis of input paddy

The steps in sampling input paddy for processing in the laboratory huller and laboratory whitener as well as determining the grain parameters are shown in Figure 1.

E.1.1 Purity

Each of the three 0.5 kg test paddy sample is cleaned and the components namely, the paddy and the impurities, are separated for weighing.

E.1.2 Moisture content

E.1.2.1 Five samples shall be taken for moisture content determination using a calibrated moisture meter.

E.1.2.2 The mean moisture content from samples shall be taken as the moisture content of the test paddy.

E.1.3 Cracked grains

E.1.3.1 Three 100-whole head grain sample is drawn for hand hulling to determine the percentage cracked brown rice.

E.1.3.2 Each grain shall be hulled carefully by hand, taking care not to use undue rubbing force or high pressure to minimize mechanical stress on the grain.

E.1.3.3 Each hulled grain or brown rice grains shall be examined for cracks under a magnifying lens against a backlight through a translucent plate or light diffuser.

E.1.3.4 Grains which show cracks or which have been broken in the process of hand hulling shall be counted as cracked grains.

E.1.3.5 The mean value determined from the three 100-grain samples shall be taken as the percentage cracked hand-hulled brown rice.

E.1.4 Weight per 1000 grains full grain test paddy

Three 1000-grain sample is drawn and weighed as soon as possible.

E.1.5 Weight of 1000 grains whole head brown rice

Take three 1000-whole head grain samples from the brown rice sample and weigh.

E.1.6 Milled rice grain parameters

E.1.6.1 Three 100-grain sample of milled rice from the laboratory whitener shall be weighed and separated into components of head rice, broken rice, and brewer's rice.

E.1.6.2 Each component shall be weighed individually to determine the percentage on weight basis

E.1.7 Weight of 1000-grain whole head milled rice

Three 1000-grain sample of whole head milled rice shall be drawn from the head rice component and then weighed.

E.1.8 Damaged grain

E.1.8.1 Three 100-grain head milled rice samples shall be drawn from the head milled rice component and examined under a magnifying lens for grain damage.

E.1.8.2 The percentage grain damage is taken as the mean value from three 100-grain sample.

E.2 Laboratory analysis of samples from test rice mill

E.2.1 Weight of 1000 grains whole head brown rice

Three 1000-grain samples of whole head brown rice shall be drawn to determine the weight of 1000 grains.

E.2.2 Coefficient of hulling

Three samples of 100 grains of huller output shall be drawn and separated into brown rice and unhulled paddy to determine the coefficient of hulling.

E.2.3 Coefficient of wholeness

E.2.3.1 Three samples of 100 grains brown rice sample is drawn and separated into broken brown rice and head brown rice.

E.2.3.2 The coefficient of wholeness is determined from the weight of the components and shall be taken as the mean of the three samples.

E.2.4 Weight of 1000 grains whole head milled rice

Three 1000-grain samples of milled rice shall be taken and weighed.

E.2.5 Grain parameters

The head milled rice recovery, total milling recovery, and percentage, on weight basis, of broken milled rice and brewer's rice shall be determined from the nominal 200-grain milled rice sample.

E.2.6 Milling degree

This parameter shall be determined by calculating from the difference in weights of 1000 grains of whole head brown rice and 1000 grains of whole head milled rice.

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Annex F (normative)

Laboratory analysis data sheet

The items to be determined during laboratory analysis shall be recorded in data sheet given in Table F.1

Table F 1 — Data sheet

Item	Trial						Mean	
	1		2		3		Control	Test
	Control	Test	Control	Test	Control	Test		
F.1 Test paddy								
F.1.1 Purity (%)								
F.1.2 Moisture content, wet basis								
F.1.3 Weight of 1000 full paddy grains (g)								
F.1.4 Cracked handhulled brown rice								
F.2 Brown rice								
F.2.1 Weight of 1000 whole head brown rice (g)								
F.2.2 Chalky and immature (%)								
F.2.3 Yellow and fermented (%)								
F.2.4 Red rice (%)								
F.2.5 Coefficient of hulling								
F.2.6 Coefficient of wholeness								
F.2.7 Hulling efficiency (%)								
F.3 Milled rice								
F.3.1 Weight of 1000 whole milled rice (g)								
F.3.2 Damaged milled rice (%)								
F.3.3 Broken milled rice (%)								
F.3.3.1 based on input paddy								
F.3.3.2 based on total milled rice								
F.3.4 Brewer's rice (%)								
F.3.4.1 based on input paddy								
F.3.4.2 based on total milled rice								

F.3.5 Head milled rice Recovery (%)								
F.3.5.1 based on input paddy								
F.3.5.2 based on total								
F.3.6 Total milling recovery (%)								
F.3.7 Milling degree (%)								

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Annex G (normative)

Formula used during calculations and testing

a) Input capacity (kg/h) = $\frac{\text{Weight of input paddy (kg)}}{\text{total loading time (h)}}$

b) Output capacity (kg/h) = $\frac{\text{Weight of milled rice (kg)}}{\text{Output time (h)}}$

c) Milling capacity (kg/h) = $\frac{\text{Weight of clean paddy (kg)}}{\text{Total operating time (h)}}$

d) Milling recovery (%) = $\frac{\text{Weight of milled rice (kg)}}{\text{Weight of clean paddy (kg)}}$

e) Coefficient of hulling, H_c

$$H_c = 1 - \frac{\text{weight of unhulled paddy (kg)}}{\text{weight of clean paddy (kg)}} \times 100$$

f) Coefficient of wholeness, W_c

$$W_c = \frac{W_s}{T_s}$$

Where ;

W_s the weight of the whole brown rice

T_s the weight of the total hulled samples

g) Hulling efficiency, H_e

$$H_e = (\text{Coefficient of hulling}) \times (\text{Coefficient of wholeness}) \times 100$$

h) Percent head rice (%) = $\frac{\text{Weight of head rice (g)}}{\text{Weight of milled rice (g)}} \times 100$

i) Broken rice (%) = $\frac{\text{Weight of broken rice (g)}}{\text{Weight of milled rice (g)}} \times 100$

j) Brewer's rice (%) = $\frac{\text{Weight of brewer rice}}{\text{Weight of milled rice (g)}} \times 100$

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