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Millet malt — Specification

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Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Trade, Industry and Cooperatives established under Cap 327, of the Laws of Uganda, as amended. UNBS is mandated to co-ordinate the elaboration of standards and is

(a) a member of International Organisation for Standardisation (ISO) and

(b) a contact point for the WHO/FAO Codex Alimentarius Commission on Food Standards, and

(c) the National Enquiry Point on TBT Agreement of the World Trade Organisation (WTO).

The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of key stakeholders including government, academia, consumer groups, private sector and other interested parties.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

The committee responsible for this document is Technical Committee UNBS/TC 203, *[Cereals, Pulses and related products and processes]*

Introduction

Malt is an important base ingredient for use in brewing and distilling industries. In addition, malt is used for preparing malt extract, malt vinegar, processed foods meant for infants, children, and medicinal preparations. In order to ensure that the end products are of an acceptable quality, it is essential that the malt used should be of appropriate quality. Therefore, in order to make available malt of proper quality to the various groups of consuming interests, this Uganda Standard is being issued. The use of Millet grain for brewing malt will vastly improve income levels of people in rural areas as well as eliminate any income loss incurred by local beverage companies when other raw materials are in short supply.

Millet, finger millet and other cereals have been used to brew traditional opaque beer since time immemorial in Africa. The brewing process involves fermentation of malted grains. Currently Millet is the main raw material used to brew opaque beer at commercial level in Uganda. Millet (*Millet bicolour*) and finger millet (*Eulicine coracana*) grains thrive in areas of low rainfall and are cultivated in drought stricken areas in East and Southern Africa

The quality of opaque beer depends on the malt quality. The quality of malt depends upon several parameters such as free amino nitrogen content, diastatic power and germination energy. Malting is a biological process that turns grain into malt. Malting of finger millet and Millet is a common technique in India and Africa and malted finger millet is considered superior to malted Millet and malted maize. Malting results in mobilization of hydrolytic enzymes such as amylases and proteases that are essential for the solubilisation of starch and proteins in the grains. This makes the grains easy to ferment. Performance of finger millet in the brewing of opaque beer by locals is commendable. Commercial sales of finger millet will financially boost people living in rural areas who produce this crop.

Millet malt — Specification

1 Scope

This standard prescribes the requirements and methods of sampling and test for Millet malt.

2 Normative references

The following referenced documents 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.

AOAC 952.13, *Arsenic in food — Silver diethyldibocarbamate method*

AOAC 972.23, *Lead in fish — Atomic absorption spectrophotometric method*

AOAC 973.34, *Cadmium in food — Atomic absorption spectrophotometric method*

AOAC 983.20, *Mercury (methyl) in fish and shellfish — Gas chromatographic method*

US 1659, *Materials in contact with food — Requirements for packaging materials*

US 28 EAS 39, *Code of practice for hygiene in the food and drink manufacturing industry*

US 738, *General standard for contaminants and toxins in food and feed*

US EAS 38, *Labelling of pre-packaged foods — General requirements*

US EAS 900, *Cereals and pulses — Sampling*

US EAS 901, *Cereals and pulses — Test methods*

US EAS 758, *Whole Millet grain — Specification*

US ISO 15089, *Water quality Guidelines for selective immunoassays for the determination of plant treatment and pesticide agents*

ISO 16649-2

AOAC 967.26

ISO 6888-1

ISO 21527-2

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
Millet malt
product of controlled steeping, germination and drying Millet grain

3.2
extract
percentage of dry substance in the malt which is soluble in water when extracted over a standard gradient regime

3.4
diastatic Power
measure of the enzymatic activity of malt (combined activity of alpha and beta amylases).

3.5

Total Nitrogen

3.6

Friability

The measure or tendency of malted grain to crush or crumble

3.7

Saccharification time

4 Requirements

4.1 General

4.1.1 Millet malt shall be prepared from Millet conforming to US EAS 758

4.1.2 Malt shall be prepared from Millet grains with a minimum of 85% germination energy to be accepted for malting purposes

4.2 Specific requirements

4.2.1 Colour-The colour of malt shall be as agreed between the purchaser and the vendor. Malt shall possess a bright appearance and shall be free from discolouration and characteristic of parent grain.

4.2.2 Flavour - Malt shall possess flavour, which is typical and characteristic of clean malt. It shall be free from any off-flavours e.g. mouldy flavours. Malt shall be sweet to taste, and shall be free from any trace of bitterness and sourness.

4.2.2 Friability

4.2.3 The size of malted kernels shall be in accordance to US EAS 757

4.3 Freedom from Impurities

4.3.1 Foreign Matter-The proportion of all matter other than malt, culms rests, etc., shall not exceed 2 percent by mass.

4.3.2 Broken Kernels - The proportion of broken kernels (which are not whole) shall not exceed 5 percent by mass.

4.3.4 Millet malt shall be free from living insects and mould, and shall be free from dead insects, insect fragments and rodent contamination visible to the eye.

4.4 Malt shall also conform to the requirements prescribed in Table I.

Table 1 — Requirements for Millet malt

S/N	Characteristic	Requirements	Method of test
1	Moisture, percent by mass, Max	8.1	
2	Yield or extraction (On dry basis). Percent by mass, Min	65	
3	Saccharification time at 70^0C (Minutes), Max	60	
4	Diastatic power (on dry basis) SDU/g, Min	20	
5	Thousand Kernel mass (on dry basis) in g, min	14	
6	Free Amino Nitrogen (FAN), Max	50	

4.5 The mash and wort when examined as given in A.3.2 and A.3.3 shall conform to the following requirements.

4.5.1 Mash- It shall be free from mouldy smell (A.3.2).

4.5.2 Wort - It may be clear, bright or slightly opalescent in appearance where applicable (A.3.3)

5 Hygiene

Millet malt shall be handled in accordance with US 28 EAS 39.

6 Microbiological limits

The maximum limits for microbiological contaminants in Millet malt shall comply with the requirements in Table 2

Table 2 — Microbiological limits for Millet malt

S/No.	Organism	Limit	Test method
i)	Yeasts and moulds, cfu per g max	10^4	ISO 21527-2
ii)	*Staphylococcus* spp., cfu per g max	10^3	ISO 6888-1
iii)	*Escherichia coli*, cfu per g	Absent	ISO 16649-2
iv)	*Salmonella* spp. per 25 g	Absent	AOAC 967.26

7 Contaminants

Millet malt shall comply with maximum levels for contaminants in accordance with US 738.

7.1 Heavy metals

Millet malt shall comply with the heavy metal limits given in Table 2 when tested in accordance with the test methods specified therein

Table 3 — Heavy metal limits for Millet malt

S/N	Heavy metal	Maximum limit mg/kg	Test method
i.	Arsenic	0.1	AOAC 952.13
ii.	Lead	0.3	AOAC 972.23
iii.	Cadmium	0.3	AOAC 973.34
iv.	Mercury	0.5	AOAC 983.20

7.2 Mycotoxins

Millet malt shall comply with the maximum limits for mycotoxins given in Table 3 when tested in accordance with the test methods specified therein.

Table 4— Mycotoxins limits for Millet malt

Mycotoxin	Maximum limit µg/kg	Test method
Total aflatoxin	10	US EAS 901
Aflatoxin B1	5	

7.3 Pesticide residues

Millet malt shall comply with those maximum pesticides residue limits given in Table 4 when tested in accordance with the test methods specified therein.

Table 5— Pesticide residue limits in Millet malt

S/N	Pesticide residue	Maximum limit mg/kg	Test method
i	Dichloro-diphenyl-trichloroethane (DDT)	0.1	US ISO 15089
ii	*Polychlorinated biphenyls* (*PCBs*)	0.01	
iii	Dioxin	0.01	

8 Weights and measures

Millet malt shall be packaged in accordance with the weights and measures regulations of the country.

9 Packaging

9.1 Millet malt shall be packaged in food grade packaging that will safeguard the hygienic, nutritional, technological, and organoleptic qualities of the product. Each package shall be securely sealed.

9.2 The packaging containers used shall conform to the requirements given in US 1659.

10 Labelling

10.1 General

In addition to the requirements in US EAS 38, each package shall be legibly and indelibly labelled with the following:

a) name of the product as “Millet malt”;

b) name, address and physical location of the producer/packer/importer;

c) lot/batch/code number/ crop year and grade;

k) declaration on whether the Millet was genetically modified, where applicable.

10.2 Labelling of non-retail containers

10.2.1 Information detailed in 9.1 shall be given either on the container or in accompanying documents, except that the name of the product, lot identification and the name and address of the processor or packer as well as storage instructions, shall appear on the container.

10.2.2 However, lot identification and the name and address of the processor or packer may be replaced by an identification mark provided that, such a mark is clearly identifiable with the enclosed documents.

11 Sampling

Sampling shall be carried out in accordance with US EAS 900.

Annex A
(normative)

DETERMINATION OF YIELD OF EXTRACT

A.1 APPARATUS

A.1.1 Grinding Mill.

Miag-Seck type. For fine grinding use cone type, 300 rev/min, and for coarse grinding roll type, 150 rev/min.

A.1.2 Mash Beaker and Counter Weight.

Made of either pure nickel stainless steel or brass and of such dimensions as '0 assure light connection between beakers and grinding mill. If counterweights are used for mash beakers, their tare should be checked frequently.

A.1.3 Mashing Apparatus

The beakers, stirrers and solder used should be of the same metal. Each stirrer should be provided with a blade, which during operation has clearance of about 2 mm from bottom and 5 mm from wall of the mash beaker. The blade is approximately 8 mm wide and each side has 45' pitch, arranged as in a propeller, to force mash upward. Speed of the mash stirrer shall be 80 to 100 rev/min; each stirrer of each beaker shall have the same speed. Stir water in the bath thoroughly by mechanical means to assure uniformity of temperature and have level of water above maximum mash level.

A.1.4 Gypsum Plate

Thoroughly mix 100 ml water with 135g plaster of paris. Pour mixture while still free flowing into suitable flat moulds.

A.1.5 Filter Paper

Whatman No. I or equivalent.

A.1.6 Funnels.

Short-stem glass funnels having approximately a diameter of 20 cm. The stem shall extend 3 to 5 cm into the receiving flask.

A.1.7 Flasks

Erlenmeyer's of 500 ml capacity**.**

A.1.8 Pknometers

A.1.9 Water-Bath

Automatically controlled**.**

A.2. REAGENTS

A.2.1 Iodine Solution.

A.2.1.1 0.01 N Solution.

Prepared by dissolving 0.63 g iodine and 1.25 g of potassium iodine in water and diluted to 500 ml.

A.2.1.2 0.02 N Solution.

Prepared by dissolving 1.27 g of iodine and 2.5 g of potassium iodine in water and diluted in 500 ml. Both these iodine solutions should be kept in dark and prepared fresh once a month.

A.3 DETERMINATION

A.3.1 Grinding

Weigh approximately 55 g of sample at room temperature into a tared mash beaker and grind through mill set for standardized fineness of grind. Collect finely ground malt in same mash beaker, carefully brushing malt particle remaining in the mill into the mash beaker. Mix and without delay place mash beaker with contents on balance accurate to within ± 0.06g, under 750 g load and adjust mass of the malt to 50 ± 0.05 g by removing excess into tared dish for moisture determination.

A.3.2 Mashing Procedure

Mash in ground malt with 200 ml water at 46QC and mix well with glass rod to prevent formation of lumps. Carefully rinse glass rod and wall of beaker with small quantity of water. Promptly place mash beakers in mashing apparatus containing water previously heated to 46°C and set the stirrers in motion. Place thermometer in each mash beaker. Keep temperature at 45°C exactly for 10 minutes from the time beakers were placed in the mashing apparatus. Raise mash temperature at the rate of 1°C per minute till it reaches 70°C.Add 100 ml water which has been previously heated to 70 to 71°C and mash for 60 10mutes at 70'C. Care should be taken that temperature deviations during mashing procedure do not exceed 0.5°C. Observe the odour of the mash; it should be free from mouldy or smoky smell (see 3.5.1).

A.3.3 Cooling and filtration

After 60 minutes, cool mash promptly (within 10 to 15 minutes) to the prevailing room temperature. Stop stirring. Remove thermometer after adhering mash particles are rinsed into the beaker with water. Remove each beaker with its stirrer from mashing apparatus. Rinse mash particles adhering to the stirrer into beaker with water. Dry outside of each beaker taking care to remove the moisture adhering to the rim. Without delay, adjust the mass of content of mash beaker 450 ± 0.05 g by adding water. Stir mash thoroughly with glass rod. Once when removing beakers from balance pan and again immediately before pouring mash onto filter (stirrings shall be not less than 5 minutes not more than 15 minutes apart).

While stirring cooled mash, take care to prevent splashing or spilling. Mix drops adhering to beaker wall into mash by rotary stirring with glass rod. Pour entire contents of beaker into funnel provided with specified filter paper. Cover funnel with approximately 20 cm diameter watch glass during the entire filtration and remove receiving flask containing wort for later observations and tests. In case of slow running worts, stop filtration after 2 hours. In case of coarse ground malt mash, collect exactly 200±2 ml wort. When filtration is complete, mix wort in receiving flask thoroughly by rotary motion. Speed of filtration is normal if filtration is complete within one hour after returning the filtrate to filter bed; slow if filtration takes longer. Observe degree of clarity and report as, clear, slightly hazy, or hazy (set 3.5.2). Remove approximately 100 ml wort for determination of colour.

A.3.4 Specific gravity

Rinse empty pyknometer twice with about 10 ml wort. Fill with wort, place in water-bath maintained at 20°C. Weigh filled pyknometer within 3 hours of completed filtration. Difference between this mass and that of empty pyknometer represents wort capacity of pyknometer at 20°C. Calculate specific gravity of wort to 5 decimal places rounding off to 0.00005 to 0.00010, by dividing mass of wort by mass of water.

A.4 CALCULATION

A.4.1 Determine extract yield of wort by reference to specific gravity values given in specific gravity table.

A.4.2 Calculate yield of extract of malt (on dry basis) as given below:

a) Extract, as is basis = P (600 + M) / (100 - P)

where

P = g extract in 100 g Wort (as calculated from specific gravity table), and

M = percent moisture in the malt.

b) Extract (on dry basis) = (E x 100)/ (100-M)

where

E = extract as-is basis, and

M = percent moisture in the malt.

APPENDIX B
(normative)
DETERMINATION OF DIFFERENCE IN YIELD OF EXTRACT BETWEEN FINE AND COARSE GRINDING

B.1 GRINDING

B.1.1 Fine Grinding

Grind malt sample as described in A.3.I, However, for fine grinding the mill shall have been standardized in such a manner that between 9 to 11 percent by mass of the material is retained on a 300 micron IS Sieve

B.1.2 Coarse Grinding

Grind malt sample as described in A.3.1.In case of coarse grinding, the mill shall have been standardized in such a manner that between 74 and 76 percent by mass of the material is retained on a 300-micron IS Sieve.

B.2. YIELD OF EXTRACT

B.2.1 Determine yield of extract of fine and coarse grinding separately and calculate difference in yield.

APPENDIX C
(normative)
DETERMINATION OF SACCHARIFICATION TIME

C.1. PROCEDURE

C.1.1 Proceed up to the stage of mashing (A.3.2). Ten minutes after the mash has reached 70°C, transfer drop of mash with thin glass rod (of about 3 mm diameter) on to an absorbent gypsum plate (A.1.4), or into a cavity of porcelain plate, and test with drop of 0.01 N iodine solution (A.2.1.1) on gypsum plate or with a drop of 0.02 N iodine solution (A.2.1.2) on porcelain plate. Make tests 5, 7 and 10 minutes after 70°C is reached and thereafter if necessary at 5-minute intervals. Conversion (saccharification) is considered complete when test drop and iodine solution produces only yellow stain on gypsum or porcelain plate.

C.1.2 Report time of saccharification in minutes.

APPENDIX D
(normative)
DETERMINATION OF MODIFICATION INDEX

D.1. PRINCIPLE

D.1.1 Modification index is the ratio of the total soluble nitrogen to total nitrogen.

D.2. TOTAL NITROGEN

D.2.1 Determine total nitrogen or malt by the method prescribed in IS 5194-1969*

D.3. TOTAL SOLUBLE NITROGEN

D.3.1 Determine total soluble nitrogen on the wort obtained from the standard hot water extract (A-3.3). Take 25 ml or the wort in 5QO-m1 Kjeldahl flask, and determine nitrogen by the method prescribed in IS: 5194-1969*, Carry out a blank determination in tbe same manner using the same quantities or all the reagents but without the sample.

D.3.2 Calculation

Total soluble Nitrogen= (V X 5.6)/W

where

V = volume in ml or standard sulphuric acid used in titration,

and

W = mass in g or dry matter in the sample.

D.4 MODIFICATION INDEX

4.1 Modification index = (A/B) X 100

where

A = total soluble nitrogen percent by mass, and

B = total nitrogen or malt percent by mass,

APPENDIX E
DETERMINATION OF COLD WATER EXTRACT

E.1 PREPARATION OF SAMPLE

E.1.1 Prepare sample of barley malt by grinding as described in A.3.1.

E.1.2 Test Portion - Weigh to the nearest 0'001 g about 25 g or the prepared sample.

E.2 PROCEDURE

E.2.1 Use distilled water or water of at least equal purity. The temperature of water to be used during extraction should be O^0C. Transfer the test portion quantitatively with water to the volumetric flask and fill to the mark with cold water. Stopper the flask and shake at approximately 30 minutes intervals for 3 hours and allow to stand overnight without shaking. Filter the extract through a dry filter paper, evaporate a 50 ml aliquot portion to dryness in the dish in the steam-bath and heat in the oven at 103±2°C to constant mass, that is, until two consecutive weighings separated by a period of one hour in the oven do not differ by more than 0.002 g. Record the final mass.

E.3 CALCULATION

E.3.1 Cold water extract, percent by mass (on dry basis) = M, X

100 100 100

50 X Mo X lOO-H

where

M_1 = mass in g of the residue obtained,

M_0 = mass in g of the test portion, and

H = moisture content, percent by mass of the test sample.

APPENDIX F
DETERMINATION OF DIASTATIC POWER

F.1 REAGENTS

F.1.1 Acetate Buffer Solution

Dissolve 68 g sodium acetate in 500 ml of 1N acetic acid and dilute to one litre with water,

F.1.2 Fehling's solution (Soxhlet modification)

Mix by Pouring Immediately' before use, equal volumes of solution *A* prepared as described under '-1.2.1 and solution *B* prepared as described under F.1.2.2. Check against 0.1 percent invert sugar solution by the method of titration described under F.2.2 so that 5 ml of Fehling's 25 solution corresponds to 0.025 33 g of invert sugar.

F.1.2.1 Solution A

Dissolve 34'639 g of copper sulphate ($CuSO_4$ $5H_2O$) in water, and 0.5 ml of concentrated sulphuric acid of sp gr 1-84 conforming to analytical reagent grade of IS 266-1961· and dilute to 500 ml in a graduated flask and allow the solution to stand for two days. Filter this solution through prepared asbestos.

F.1.2.2 Solution B

Dissolve 173 g of Rochelle salt [potassium-sodium tartrate ($KNaC_4H_4O_8$. $4H_2O$)] and 50 g of sodium hydroxide, analytical reagent (conforming to IS:376-1969t) in water, dilute to 500 ml in a graduated flask and allow the solution to stand for two days. Filter this solution through prepared asbestos.

F.1.3 Methylene blue solution

Dissolve 1.0 g of methylene blue in water and dilute to 100 ml.

F.1.4 Sodium Chloride

0.5 percent.

F.1.5 Starch Solution

The final concentration shall represent 2 g soluble starch (weighed on dry basis) In 100 ml solution. The soluble starch to be used should be specially suitable for determining diastatic power, shall possess solubility at least I: 50 in hot water, shall contain no dextrins, shall contain less than 0.75 percent reducing substances calculated as maltose, has moisture content of 10 to 12 percent and freshly made 2 percent solution shall have pH of 4.5 to 5.5 without adjustment with buffer

F.1.5.1 Macerate starch with just enough cold freshly distilled water to form smooth, thin paste. Pour, with constant stirring, into boiling fresh distilled water representing not less than approximately 75 percent of final volume of starch solution, at such a rate that boiling does not cease. Continue boiling for 2 minutes after thin paste is completely added. Quickly add to beaker additional 10 percent of final volume of cold, freshly distilled water and transfer mixture quantitatively to glass stoppered volumetric flask. Mix by inverting flask, wash down neck off task, and cool to 20°C before adding buffer solution. Add 2 ml buffer solution for each 100 ml of final volume of starch solution and dilute to the mark. Mix again by inverting flask and keep tightly stoppered at 20°C until used.

F.1.6 Soluble Starch Indicator

One percent soluble starch in 30 percent sodium chloride solution. Prepare soluble starch suspension and pour slowly into boiling water. Add sodium chloride and dilute to volume. (Solution should be transparent and colourless.)

F.2 DETERMINATION

F.2.1 Grind separately not less than 25.5 g malt as in A.3.1. Collect finely ground malt in mash beaker, carefully brushing in malt particles remaining in mill. Without delay, adjust mass of contents to 25±0.5 g.

Transfer quantitatively to container (about I litre capacity) in which infusion is to be made. Add 500 ml of 0'5 percent sodium chloride solution at 20°C and close the container. Let infusion stand for 2.5 hours at 20 ± 0.2°C and agitate by rotating at 20-minute intervals. Take care that in agitation of malt suspension as small quantity of grit as possible is left adhering to inner surface of flask above level of the water. (Do not invert flask to mix; gentle whirling of contents without splashing on sides of container is sufficient.) Filter infusion by transferring entire charge to a fluted filter. Return first 50 ml filtrate to filter, Collect filtrate for 3 hours after water and ground malt were first mixed. Prevent evaporation during filtration as far as possible by placing water on watch-glass over funnel and some suitable cover around stem of funnel, resting on neck of receiver. Immediately dilute 20 ml of this infusion to 100 ml with 0'5 percent sodium chloride solution at 20DC. Transfer 10 ml diluted infusion to 250 ml volumetric flask and bring to 20°C. Add 200 ml buffered starch solution from fast flowing pipette all at 20°C. Mix solution by rotating flask during addition. Keep starch infusion mixture at 20 ± 0.1 ºC exactly for 30 minutes timed on stop-watch from time addition of starch was begun. Add 20 ml of 0'5 N sodium hydroxide rapidly and mix well by whirling the flask. Dilute to the mark at 20°C and mix thoroughly.

F.2.2 Boil 10 ml of the Fehling's solution and 10 ml water in a 200ml Erlenmeyer flask, add from burette about two-thirds of quantity of digested starch solution (F.2.1) and boil for 15 to 20 seconds rotating constantly. Remove from heat. If still decidedly blue, add more solution, boil for about 10 minutes and again observe colour. When blue is almost discharged, and after solution boils gently for about 2 minutes, add 3 drops of methylene blue solution. Continue boiling and add more solution until 0'1 ml, or ,even one drop, discharges blue upon boiling. Repeat titration adding at once almost whole quantity of digested starch required, and proceed to end-point as directed. Designate quantity of digested starch solution required to reach end point in this second titration as 'A', Interrupt boiling as little as possible after indicator is added, so that flask remains .filled with steam, preventing much excess of air. Prepare blank by processing exactly as in F.2.1. Except that, add the 0.5 N sodium hydroxide to malt infusion before adding the starch solution. To 10 ml of the Fehling, solution and 10 ml of water add a volume of this blank solution equal to final volume of digested starch solution. Boil and again determine end-point as in the determination. Designate quantity of digested starch solution used as 'B'.

F.3 CALCULATION

F.3.1 Diastatic Power (as in basis)

= (5 OOOIA) x (BIA)

where

A = volume in ml of digested starch solution, and

B = volume in ml of digested starch solution required to reduce 10 ml of Fehling's solution.

F.3.2 Diastatic power (on dry basis)

= *(DP* x 100)/(100 - *M}*

where

DP = diastatic power, as-is b... is; and

M = percent by mass of moisture in the sample.

Bibliography

[1] IS 6895 -1973, *Indian Standard specification for barley malt*

[2] US 334:2020, *Barley grains — Specification*

[3] India Online ISSN: 2319-7064, Volume 2 Issue 9, September 2013, *International Journal of Science and Research (IJSR)*

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