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HIGH QUALITY CASSAVA FLOUR - SPECIFICATION

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High quality cassava flour — Specification



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Introduction

High quality cassava flour (HQCF) can be used as an alternative for starch and other imported materials like wheat flour in a number of industrial undertakings. High quality cassava flour can be used in the production of adhesives for paperboard manufacture, as an extender for plywood glues, as a source of starch in textile sizing and as a raw material for the production of glucose syrups, industrial alcohol and bakery products.

The processing of cassava into high quality cassava flour involves peeling, washing, grating/slicing/chipping, pressing, disintegration, sifting, drying, milling, screening, packaging and storage.

High quality cassava flour can be prepared from both sweet and bitter varieties. Annex A provides further information on the preparation of high quality cassava flour and its applications.

ENQUÊTE PUBLIQUE N° 19

High quality cassava flour — Specification

1 Scope

This African Standard specifies requirements, methods of sampling and test for high quality cassava flour, which is obtained from the processing of cassava (*Manihot esculenta* Crantz), intended for human consumption.

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.

ARS 53, *General principles of food hygiene — Code of practice*

ARS 56, *Prepackaged foods — Labelling*

ARS 471, *Food grade salt — Specification*

ARS 835, *Fresh sweet cassava — Specification*

ARS 836, *Fresh bitter cassava — Specification*

ARS 839, *Dried cassava chips — Specification*

ARS 844, *Cassava and cassava products — Determination of total cyanogens — Enzymatic assay method*

CODEX Stan 192, *General standard for food additives*

CODEX STAN 193, *Codex general standard for contaminants and toxins in food and feed*

ISO 750, *Fruit and vegetable products — Determination of titratable acidity*

ISO 1666, *Starch — Determination of moisture content — Oven-drying method*

ISO 1842, *Fruit and vegetable products — Determination of pH*

ISO 2171, *Cereals, pulses and by-products — Determination of ash yield by incineration*

ISO 2447, *Fruit and vegetable products — Determination of tin content*

ISO 4833, *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of microorganisms — Colony-count technique at 30 degrees C*

ISO 5498, *Agricultural food products — Determination of crude fibre content — General method*

ISO 5517, *Fruits, vegetables and derived products — Determination of iron content — 1,10-Phenanthroline photometric method*

ISO 6561-1, *Fruits, vegetables and derived products — Determination of cadmium content — Part 1: Method using graphite furnace atomic absorption spectrometry*

ISO 6561-2, *Fruits, vegetables and derived products — Determination of cadmium content — Part 2: Method using flame atomic absorption spectrometry*

ISO 6579, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection of Salmonella spp.*

ISO 6633, *Fruits, vegetables and derived products — Determination of lead content — Flameless atomic absorption spectrometric method*

ISO 6634, *Fruits, vegetables and derived products — Determination of arsenic content — Silver diethyldithiocarbamate spectrophotometric method*

ISO 6636-1, *Fruits, vegetables and derived products — Determination of zinc content — Part 1: Polarographic method*

ISO 7251, *Microbiology of food and animal feeding stuffs — Horizontal method for the detection and enumeration of presumptive Escherichia coli — Most probable number technique*

ISO 7952, *Fruits, vegetables and derived products — Determination of copper content — Method using flame atomic absorption spectrometry*

ISO 10520, *Native starch — Determination of starch content — Ewers polarimetric method*

ISO 16050, *Foodstuffs — Determination of aflatoxin B₁, and the total content of aflatoxin B₁, B₂, G₁ and G₂ in cereals, nuts and derived products — High performance liquid chromatographic method*

ISO 21527-2 *Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of yeasts and moulds — Part 2: Colony count technique in products with water activity less than or equal to 0.95*

ISO 24333, *Cereals and cereal products — Sampling*

3 Terms and definitions

For the purpose of this standard the following terms and definitions apply.

3.1

high quality cassava flour (HQCF)

unfermented cassava flour prepared from fresh mature cassava roots through a process of sorting, peeling, chipping or grating followed by dewatering, drying, milling, sifting and packaging

3.2

food grade material

material that is free from substances that are hazardous to human health

3.3

specks

tiny marks, spots or piece of any other object present in the flour

3.4

extraneous matter

organic matter of cassava origin other than high quality cassava flour

3.5

foreign matter

organic and inorganic materials (such as sand, soil, glass) other than extraneous matter in the flour

4 Quality requirements

4.1 Raw materials

HQCF shall be produced from selected fresh mature cassava roots or from high quality intermediate products such as chips and grits shall be processed within 24hrs.

4.2 General requirements

High quality cassava flour shall be:

- a) practically free from extraneous matter;
- b) free of off flavours and odours;
- c) practically free from any living insects and foreign matter;
- d) safe and suitable for human consumption; and
- e) of colour characteristic of the variety.

4.3 Physical properties

Testing for particle size shall be done in accordance with ISO 3588. High quality cassava flour shall have the following physical properties:

- a) Not less than 95 % by mass of high quality cassava flour shall pass through a sieve of 250 μm mesh screen; and
- b) Extraneous matter shall not be more than 10 specks/100 cm^2 .

4.4 Specific requirements

High quality cassava flour shall conform to the compositional quality requirements shown in Table 1.

Table 1 — Compositional requirements for high quality cassava flour

S/N	Parameter	Requirement	Method of test
1	Total acidity, %, by mass, max.	0.25	ISO 750
2	pH	5.5 – 7.0	ISO 1842
3	Acid insoluble ash, % m/m on dry matter basis, max.	0.35	Annex A
4	Total cyanogens (as HCN), mg/kg, max.	10.0	ARS 844
5	Starch content by mass, %, by mass, min.	60.0	ISO 10520
6	Moisture content, %, by mass, max.	12	ISO 1666
7	Crude fiber, %, by mass on dry weight basis, max.	0.2	ISO 5498
9	Total Aflatoxin (AFB ₁ +AFB ₂ +AFG ₁ +AFG ₂), ppb max	10	ISO 16050
10	Aflatoxin B ₁ only, ppb max	5	

4.5 Chemical properties

High quality cassava flour shall:

- a) give a blue-black colouration when tested with iodine; and
- b) have a pasting temperature less than 75 °C.

5 Food additives

Food additives may be used in the preparation of high quality cassava flour in accordance with CODEX STAN 192.

6 Contaminants**6.1 Pesticide residues**

High quality cassava flour shall conform to maximum residue limits for pesticide residues established by the Codex Alimentarius Commission for this commodity.

6.2 Other contaminants

6.2.1 Metal contaminants shall have limits as specified by CODEX STAN 193 in addition to the following:

Table 3 — Maximum limits for metallic contaminants

S/No	Contaminant	Maximum level (mg/kg)	Method of test
1	Arsenic	0.1	ISO 6634
3	Lead	1.0	ISO 6633
4	Cadmium	0.1	ISO 6561-1, -2
5	Tin	15.0	ISO 2447

6.2.2 The product shall be free from objectionable extraneous matter.

6.2.3 High quality cassava flour shall contain not more than 10 microgram per kilogram aflatoxin of which not more than 5 micrograms per kilogram may be aflatoxin B1 when tested in accordance with ISO 16050.

6.2.4 The product shall be free from microorganism which represent a hazard to health (Table 2).

7 Hygiene

7.1 The product covered by the provisions of this standard shall be prepared and handled in accordance with ARS 53 and shall conform to microbiological limits specified in Table 2.

Table 2 — Microbiological limits for high quality cassava flour

S/N	Micro-organism(s)	Requirements	Method of test
1	Total plate count, cfu/g	10 ⁴	ISO 4833
3	<i>Escherichia coli</i> , cfu/g, max.	absent	ISO 7251
4	<i>Salmonella</i> , 25g, max.	absent	ISO 6579
5	Yeasts and moulds, cfu/g, max.	10 ²	ISO 21527-2

7.2 During handling, storage and transportation, effective measures must be taken to prevent cross contamination with chemicals, microbial or physical contaminants.

8 Packaging

8.1 High quality cassava flour shall be packaged in food grade material which will safeguard the hygienic, physical, nutritional and organoleptic qualities of the product.

8.2 The net weight of the packages for high quality cassava flour may be required to meet the relevant regulations of the destination country.

9 Marking and labelling

9.1 In addition to the requirements of ARS 56, the following specific labelling requirements shall apply and shall be legibly and indelibly marked:

- a) Common name of the product "High quality cassava flour";
- b) Name, and physical address of the manufacturer/ distributor and /or trade name/ brand name;
- c) Declaration of preservative by common name or international number if any;
- d) Date of manufacture;
- e) The words "Food for human consumption"
- f) Lot / batch identification in code or clear;
- g) Expiry date;
- h) Country of origin;
- i) The net weight in metric units; and
- j) Instructions on disposal of used package.

9.2 When labelling non-retail packages, information for non-retail packages shall either be given on the packages or in accompanying documents, except that the name of the product, lot identification and the name and address of the manufacturer or packer shall appear on the packages.

10 Sampling

Sampling of high quality cassava flour shall be done in accordance with ISO 24333.

Annex A
(informative)

Product developments from high quality cassava flour

A.1 Introduction

Cassava flour is traditionally obtained from receiving roots which later are washed and/or peeled and after that grated or chipped into slices or chips (Abass *et al.*, 2001; Aristizábal *et al.*, 2017). These can be dried on concrete floors by the sun, on trays or in artificial dryers (rotatory, trays, fixed bed or flash). The commonest technique applied is drying cassava chips by the sun, which depends on sunny seasons and large spaces. The dried chips are milled and the flour is sieved to obtain refined flour which finally is packaged and stored.

Wheat and its flours imports represent a major burden on the economy of importing countries including trade imbalance, overdependence on foreign foods, loss of foreign exchange, food insecurity, as well as displacement of local food, with detrimental effects on the agricultural and technological development of these regions (Ohimain, 2014). The need for strategic development and use of local resources for producing low cost foods, such as bread and baked foods has been recognized by organizations such as the Food and Agriculture Organization of the United Nations (FAO), the International Center for Tropical Agriculture (CIAT) and the International Institute of Tropical Agriculture (IITA). Inclusion of cassava flour as composite for production of foods such as noodles, breakfast cereals, cookies, breads, cakes, pastries, muffins and doughnuts among others could reduce costs and increase the production of these products locally (Sanni *et al.*, 2006). Measures to promote the use of cassava flour in tropical countries, particularly cereals importing countries, remain active. The implementation of these measures can be enhanced by ensuring that cassava flour meets relevant standards which improve the quality of composite flours in order to produce palatable recipes.

A.2 Production/processing

The production of HQCF is based on a manual hand tools method (Abass *et al.*, 2001) and a mechanized method (Aristizábal *et al.*, 2017) both of which are suitable for small and medium enterprises. The methods are suitable for processing both cassava of high and low cyanogenic potential. The production of HQCF requires a strict adherence to good manufacturing practices in order to obtain a final product with desirable qualities. Cassava roots for this process must be of high quality, in good state of health, without signs of rot and must have been harvested 9–12 months after planting (Dziedzoave *et al.*, 2006). Roots older than 12 months reduce yield of flour and fail to meet industrial standards for starch and fibre when used for the production of HQCF. Production of HQCF must be done within 24 hrs after harvesting cassava roots and begins with sorting and peeling of roots. Subsequent unit operations must follow one another immediately in order to eliminate the likelihood of fermentation.

Only healthy roots should be selected for processing. Once peeled, the roots must immediately be transferred into wash water in order not to overexpose them to air and cause discolouration. Washing follows peeling and must be thoroughly done with clean potable water to rid roots of dirt, mud and offensive odour. The washed roots are then grated or chipped/sliced, depending raw material type, intended use of final product and equipment available. Chipping/slicing is used as a substitute for grating if low cyanogen potential cassava is used. This however, cannot replace grating when high cyanogen potential cassava is used for the production of food grade HQCF. This is because chipping/slicing may not adequately detoxify high cyanogenic potential cassava as endogenous enzymes do not have enough contact time with the cyanogenic compounds. Size reduction is followed by dewatering. The grated or chipped/sliced cassava is packed in sacks and pressed to remove water before sifting and drying. While screw presses or simple hydraulic systems are used on small scale production, centrifuges are used on large scale processing. After pressing, moisture content of cake ranges between 45-50%. The pressed cake is then broken down into smaller bits by hand-sifting or using a mechanical grater. This step makes drying of the grated or chipped faster and

more uniform. Drying immediately follows sifting to reduce the moisture content of the mass/grits to a range of 10 – 12 %. This can be achieved using a solar dryer, mechanical dryer or flash dryer. Once desired moisture content is attained, the grits are milled in a hammer mill to fine HQCF of required particle size that ranges between 250 – 500 μ . Sifting may become necessary if a disc attrition mill is used to mill the dried grits. The HQCF obtained from the process is then packaged in sacks lined with polyethylene bags with good moisture barrier properties, sealed and stored. A flow diagram of the production process is shown in Figure A.1.

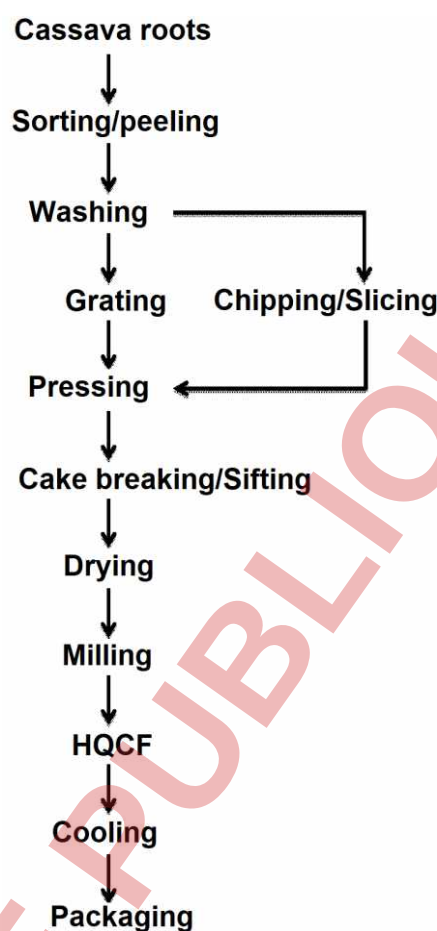


Figure A.1 — Flow diagram for small-scale processing of cassava roots into HQCF (Abass *et al.*, 2001)

When using mechanized systems, the refined cassava flour production process comprises the steps of receiving, washing, chipping; drying, milling and refining (see Figure A.2) (Aristizábal *et al.*, 2017).

Reception: After harvesting cassava roots are transported to the processing plant. There the cassava is weighed to estimate its dry matter content using the technique of specific gravity which is possible also estimate the production yield. Subsequently, the roots are deposited in a feeding hopper which leads to a sand trap which rotates allowing that excess of impurities such as adhered soil, rootlets, and the peduncle are removed.

Washing: The roots are driven by conveyor belt to a wash machine which consists of a horizontal cylinder with holes. The load on the machine is 200 kg. The roots are washed using water under pressure for about 5 minutes. On average 1 m³ of water is required to wash 1 ton of cassava roots. The combination of water and friction between roots and the drum inner walls removes impurities and the thin outer peel. To improve the microbiological quality of cassava flour, at the end of the washing may be used a disinfectant solution of sodium hypochlorite at 10 ppm washing the roots during 2 minutes.

Chipping: In this stage the size of cassava roots is reduced to increase the area of heat transfer and accelerate the drying process. The roots are chipped using a machine which has a vertical disc rotating with several fluted trapezoidal blades that turn at 1200 rpm. A typical cassava chip is a rectangular piece of about 0.5 cm² cross section area and 3 cm length, which has moisture content between 58-70 %. The drying time depends on the size of cassava chips.

Drying: Cassava chips can be dried by sun or using artificial dryers to reduce moisture content (mc) to 10-12 %. Drying is a critical stage; it should be uniform to avoid fermentation problems or microbial contamination of the flour.

Milling and refining: The dried cassava chips are milled through a hammer mill which has expanded mesh which reduces refine the flour rejecting small materials such as thin outer peel, and fibre pieces. The material that passes through the mesh enters a cylindrical mill-sieve, after which it is sucked by a centrifugal fan that transports the material to a pair of cyclones. The operating conditions of refining can be varied in accordance with the refinement requirements to obtain either refined flour or whole flour.

Subsequently, the refined cassava flour is packed into plastic bags and stored on wooden pallets in a place free of moisture, contamination and insect pests.

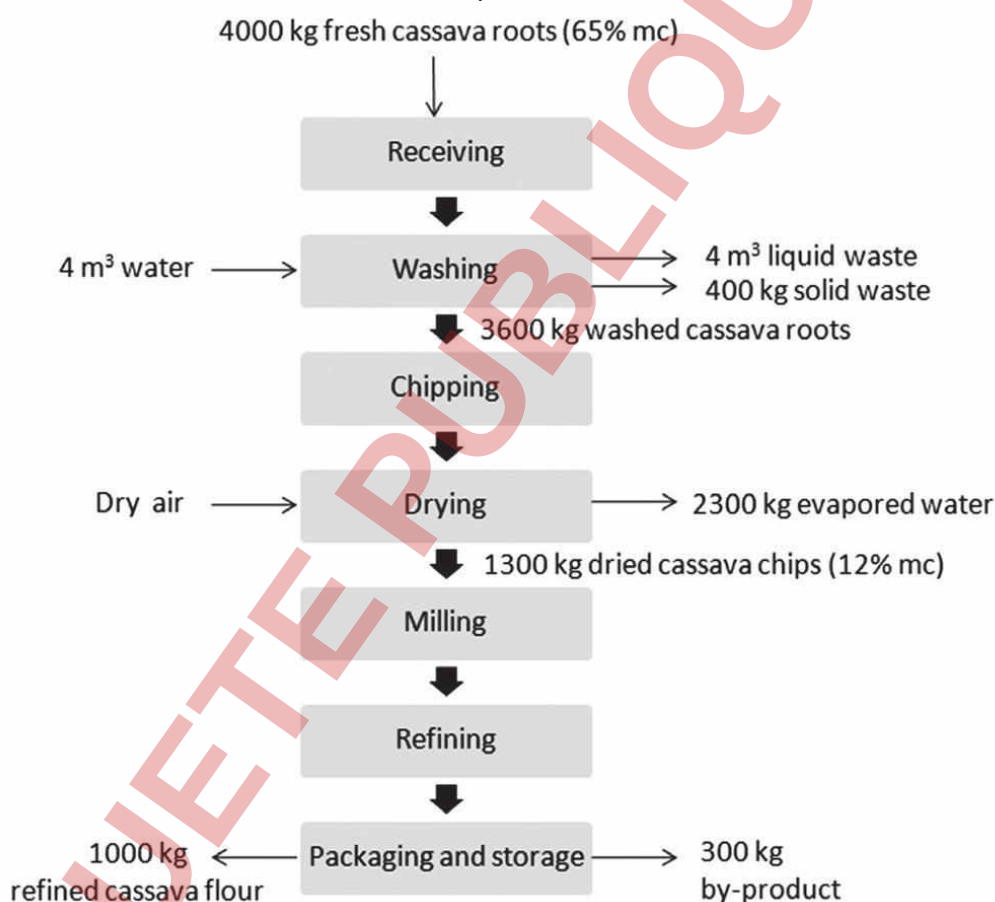


Figure A.2 — Mass balance of production of refined cassava flour (Aristizábal *et al.*, 2017)

In general, the yield process for obtaining refined cassava flour is:

- 3 kg cassava roots: 1 kg dried cassava chips (12 % mc).
- 1.3 kg dried cassava chips: 1 kg refined cassava flour (12 % mc).

The conversion factor of cassava roots to refined cassava flour depends on the dry matter content of cassava roots as well as of levels of impurities in the raw material and losses occurring in the process.

Table A.1 — Recommended inclusion levels of HQCF in different cassava-based products in composite with wheat, maize and soy flours (Dziedzoave *et al.*, 2006; Ekwuru *et al.*, 2013; Aristizábal *et al.*, 2017)

Group of end users	Product/end-use	Inclusion levels
Bread bakers	Bread, including French bread (Baguette)	20 – 40 %
Food factories	Biscuits	10 – 50 %
	Wafers	10 %
	Noodles, macaroni, spaghetti	25 – 50 %
	Bouillon cooking cubes	20 %
Home caterers	Cakes	100 %
	Chinchin	25 – 100 %
	Meat/fish pie	10 – 100 %
	Buns, fish rolls	10 – 12.5 %
	Puff-puff, etc	10 – 25 %
Restaurants	Stiff porridge (cassava-maize sembe/ugali/pap)	10 – 18 %
Others	Adhesives in composite with native starch	
Industrial non-food factories	Paper	0 – 96 %
	Matches (starch residue is preferred)	50 %
	Textile	20 – 50 %
	Extender in plywood manufacture	30 – 100 %

Annex B (normative)

Determination of acid insoluble ash

B.1 Reagent

B.1.1 Dilute Hydrochloric Acid — 1:1, prepared from concentrated hydrochloric acid.

B.2 Procedure

B.2.1 Weigh accurately about 2 g of the dried material in a tared porcelain, silica or platinum dish. Ignite with a meker burner for about 1 hour. Complete the Ignition by keeping in a muffle furnace at 500 °C to 570 °C until grey ash results.

Cool and filter through whatman filter paper No. 42 or its equivalent. Wash the residue with hot water until the washings are free from chlorides as tested with silver nitrate solution and return the filter paper and residue to the dish. Keep it in an electric air oven maintained at 135 ± 2 °C for about 3 hrs. Ignite the dish again for about 30 minutes, cool and weigh. Repeat this process till the difference between two successive weighings is less than 1 mg. Note the lowest weight.

B.3 Calculation

B.3.1 Acid insoluble ash, per cent by weight

$$= \frac{100(M_2 - M)}{M_1 - M}$$

where,

M_2 = the lowest weight, in g, of the dish with the acid insoluble ash;

M = weight, in g, of the empty dish; and

M_1 = weight, in g, of the dish with the dried product taken for the test.

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