

## **Cereal and Pulses – Specification for Fortified maize (corn) Flour**

### **1. Scope**

This Sierra Leone Standard specifies requirements and methods of sampling and test for fortified maize (corn) products namely: maize meal and maize flour from the grains of common maize (*Zea mays L.*) intended for human consumption, i.e., ready for its intended use as human food, presented in packaged form or sold loose from the package directly to the consumer.

### **2. References**

The following references contain provisions that are applicable to this Sierra Leone Standard. At the time of publication, the editions indicated were valid. All Standards are subject to revision and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent edition of the Standards indicated below:

- 2.1** SLS 2:2010 Food Technology – General principles of food Hygiene.
- 2.2** SLS 4:2010 General Standard for the labeling of Pre-packaged foods.
- 2.3** SLS 30: 2010 – Spices and Condiments – Specification for salt fortified with iodine
- 2.4** SLS 35:2010 – Microbiological analysis of foods- Sampling plans and Microbiological Criteria
- 2.5** SLS 68: 2014 – Cereal and Pulses – Specification for maize grains
- 2.6** ARS 466, Milled maize products – Specification
- 2.7** CAC/GL 1, General Guidelines on claims
- 2.8** CAC/GL 2, Guidelines on nutrition labeling
- 2.9** CAC/GL 23, Guidelines for use of nutrition and health claims
- 2.10** CODEX Stan 192 – Specification for Food Additives
- 2.11** CODEX STAN 193-1995 - Codex General Standard for Contaminants and Toxins in Food and Feed
- 2.12** ISO 711, Cereals and cereal products — Determination of moisture content (Basic reference method)
- 2.13** ISO 712, Cereals and cereal products — Determination of moisture content – Routine reference method)
- 2.14** ISO 2171, Cereals and cereal products - Determination of ash yield by incineration

**2.15** ISO 4833, Microbiology of food and animal feeding stuffs – Horizontal method for the enumeration of microorganisms – Colony – count technique at 30 degree C

**2.16** ISO 5498, Agricultural food stuffs – Determination of crude fibre content – General method

**2.17** ISO 6579, microbiology of food and animal feeding stuffs – horizontal method for the detection of salmonella spp.

**2.18** ISO 6888-1, Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (*Staphylococcus aureus* and other species) — Part 1: Technique using Baird-Parker agar medium

**2.19** ISO 6888-2, Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (*Staphylococcus aureus* and other species) — Part 2: Technique using rabbit plasma fibrinogen agar medium

**2.20** ISO 6888-3, Microbiology of food and animal feeding stuffs — Horizontal method for the enumeration of coagulase-positive staphylococci (*Staphylococcus aureus* and other species) — Part 3: Detection and MPN technique for low numbers

**2.21** ISO 7251, Microbiology of food and animal feeding stuffs – horizontal method for the detection and enumeration of presumptive *Escherichia coli* – most probable number technique.

**2.22** ISO 7305, Milled cereal products – Determination of fat acidity

**2.23** ISO 7954, Microbiology — General guidance for enumeration of yeasts and moulds – Colony count technique at 25° C.

**2.24** ISO 24333, Cereals and Cereal products — sampling

**2.25** ISO 16050, Foodstuffs — Determination of aflatoxin B<sub>1</sub>, and the total content of aflatoxin B<sub>1</sub>, B<sub>2</sub>, G<sub>1</sub> and G<sub>2</sub> in cereals, nuts and derived products — High performance liquid chromatographic method

**2.26** ISO 20483, Cereals and Pulses – Determination of Nitrogen Content and Calculation of the Crude Protein – Kjeldahl Method

**2.27** 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

**2.28** ISO 11085, Cereals, Cereals-based products and animal feeding stuffs – Determination of crude fat and total fat content by the Randall Extraction method

**2.29** CAC/MRL 1 – Maximum Residue Limits (MRL) for Pesticides

### **3. Definitions**

#### **3.1 diluent**

means suitable, inert, edible food-grade carrier for micronutrients

#### **3.2 premix**

a blend of fortificants and diluents formulated to provide specified and determinable amounts of micronutrients

#### **3.3 fortified milled maize products**

Means meal, maize flour or sifted meal to which micronutrients have been added in accordance with this standard

### 3.4 fortificant

means a compound which contains the specified micronutrients intended to be added to a food vehicle

### 3.5 food fortification

means a practice of deliberately adding essential micronutrients in a food to improve the nutritional quality of the food and to provide a public health benefit with minimal risk to health

## 4. Quality Requirements

### 4.1 Raw Materials

The fortified milled maize products shall be produced from shelled maize complying with SLS XX: 20XX – Cereal and Pulses – Specification for maize grains

### 4.2 General requirements

Fortified milled maize products shall be:

- of natural colour conforming to the colour of maize from which it was prepared
- practically free from foreign matter such as insects, fungi and dirt
- free from fermented musty or other objectionable colours
- free from rancidity and foreign odours
- wholesome and fit for human consumption in all aspects

### 4.3 Specific requirements

Fortified milled maize products shall comply with the compositional requirements given in Table 1 below.

**Table 1: Specific requirements for fortified Milled Maize products**

Characteristics	Type of product				Method of test
	Sifted maize meal	Granulated maize meal	Whole maize meal	Maize flour	
Moisture content % m/m,	13	13	13	13	ISO 711 or ISO 712
Crude fibre content, % by mass, max	0.7	1.0	3.0	0.7	ISO 5498
Crude fat a moisture free basis, % by mass, max	2.25	2.25	3.1		ISO 11085
Total ash, % by mass, max	1.0	1.0	3.0	1.0	ISO 2171
Acid insoluble ash, % by mass,max	0.15	0.35	0.40	0.15	Annex A
Crude Protein(N x 6.25), % by mass, min	7.0	7.0	8.0	7.0	ISO 20483
Fat acidity, mg KOH per 100g of product, on a dry mass basis, max	50	50	50	50	ISO 7305

## 5. Fortification requirements

### 5.1 levels of micronutrients

The fortified milled maize products shall conform to the requirements and the levels of micronutrients provided in Table 2 below.

**Table 2: Requirements for levels of micronutrients in fortified Milled Maize products**

Nutrients	Fortificant compound	Recommended factory levels, mg/kg	Regulatory levels, mg/kg	
			Minimum	maximum
Vitamin A	Vitamin A (Retinyl) palmitate,	$1 \pm 0.4$	0.5	1.4
Vitamin B <sub>1</sub>	Thiamine Mononitrate	$6.5 \pm 2.9$	3.0	(9.4) <sup>*</sup>
Vitamin B <sub>2</sub>	Riboflavin	$4 \pm 1.8$	2	(5.8) <sup>*</sup>
Niacin	Niacinamide	$30 \pm 13.4$	14.9	(43.4) <sup>*</sup>
Vitamin B <sub>6</sub>	Pyridoxine	$5 \pm 2.5$	2	(7.5) <sup>*</sup>
Folate	Folic acid	$1.2 \pm 0.5$	0.6	1.7
Vitamin B <sub>12</sub>	Vitamin B <sub>12</sub> 0.1%,WS	$0.015 \pm 0.007$	0.007	(0.022) <sup>*</sup>
zinc	Zinc oxide	$49 \pm 16$	33	65
Total iron	Total iron	$31 \pm 10$	21	41
Added iron	NaFeEDTA	$20 \pm 10$	10	30
<sup>*</sup> the figures in brackets may not be necessary because the upper tolerable limit for these nutrients is very high				

### 5.2 Fortificants

Fortificants for use shall be stable compounds conforming to specifications in any of the following documents:

- British Pharmacopoeia (BP)
- Food Chemical Codex (FCC)
- Merck Index (MI)
- United States National Formulary (NF)
- European Pharmacopoeia (Ph. Eur)
- United States Pharmacopoeia(USP);
- FAO/WHO Codex Alimentarius Commission (CAC)

### 5.3 Premix

The fortificants shall be mixed with diluents or carrier as appropriate to form a premix. Diluents or carriers shall conform to USP, BP, Ph. Eur, NF, MI, FAO/WHO CAC or FFC.

The premix shall be made in such a way that at a given rate of addition to the product, the product shall conform to the requirements in Table 2 above.

The premix may be formulated to conform to the provisions given in Table 3 below.

Note: This premix formulation is designed with minimum nutrient composition and does not take into consideration factory overages in the preparations of the premix.

**Table 3 – Formulation of premix for addition of micronutrients to Milled Maize products**

Nutrient	Fortificant compound	Amount of micronutrients to be added to food, mg/kg	Amount of fortificant to be added to food, mg/kg	Amount of fortificant in premix, g/kg	Amount of nutrients in premix, g/kg
Vitamin A	Retinyl palmitate – 250,000 IU/g (dry)	1.0	13.3	26.7	2
Vitamin B <sub>1</sub>	Thiamine Mononitrate,	4.5	5.6	11.1	9
Vitamin B <sub>2</sub>	Riboflavin	3.0	3.0	6.0	6
Vitamin B <sub>3</sub> (Niacin)	Niacinamide	25.0	25.3	50.5	50
Vitamin B <sub>6</sub>	Pyridoxine	5.0	6.1	12.2	10
Vitamin B <sub>9</sub> (folate)	Folic acid	1.0	1.1	2.2	2
Vitamin B <sub>12</sub>	Vitamin B <sub>12</sub> , 0.1%,WS	0.015	15.0	30.0	0.03
Iron	NaFeEDTA	20	153.8	307.7	37
Zinc	Zinc oxide	40	50.0	100.0	80
	Filling material (at least 25%)		68.3	453.6	
		<b>TOTAL</b>	<b>341.5</b>	<b>1000.0</b>	

The premix shall be labelled with the additional rate (that is the amount of premix to be added to the milled maize products) in grams of premix per metric tonne of maize product and dilution factor.

Where the premix is made in accordance with Table 3, the addition rate shall be 500g of premix per metric tonne of maize flour.

## 5.4 Stability of fortificants and premixes

The fortificants and premixes shall have storage stability such that no more than 20% of its original activity will be lost when stored for 21 days at 45 °C in a well closed container at a level 2.5 g per kg in milled maize product having moisture content in the range of 13.5% -14.5%.

The supplier of the premix shall provide the stability data for the fortificants and premixes.

## 6 Food Additives

The product shall contain food additives in accordance with CODEX STAN 192.

## 7. Contaminants

### 7.1 Heavy metals

Fortified milled maize products shall conform to those maximum limits for heavy metals in Table 4.

**Table 4: Limits for Heavy Metals**

Element	Maximum limits mg/kg (ppm)	Method of test
Copper	2.0	ISO 6869
Lead	0.1	ISO 6633 or AOAC 974.27
Arsenic	0.1	AOAC 986.15
Mercury	0.01	

### 7.2 Pesticide residues

Fortified milled maize products shall comply with those maximum residue limits provided in Table 5 below.

**Table 5: Maximum residue limit for fortified maize product**

Type	Unit symbol	Limit	Note
Methyl bromide	mg/kg	0.01	(*)Po
Methyl bromide	mg/kg	1	Po
Phorate	mg/kg	0.05	
Paraquat	mg/kg	0.05	
Sulfuryl fluoride	mg/kg	0.1	Po
Propargite	mg/kg	0.2	

Note: (\*) at or about the limit of determination

Po the MRL accommodate post-harvest treatment of the commodity

### 7.3 Mycotoxins

Fortified milled maize products shall not exceed total aflatoxin of 10µg/kg and 5µg/kg for aflatoxin B<sub>1</sub> when tested in accordance with ISO 16050.

## 8. Hygiene

**8.1** It is recommended that the product covered by the provisions of this standard be prepared and handled in accordance with the appropriate sections of SLS 2: 2010 – *General Principles of Food Hygiene*, and other Codes of Practice recommended by the Codex Alimentarius Commission which are relevant to this product.

**8.2** When tested by appropriate methods of sampling and examination, the product:

- shall be free from micro-organisms in amounts which may represent a hazard to health;
- shall be free from parasites which may represent a hazard to health; and
- shall not contain any substance originating from micro-organisms in amounts which may represent a hazard to health.

**8.3** The product shall be free from pathogenic micro-organisms and shall comply with microbiological limits in Table 6.

**Table 6: Microbiological limits for milled maize products**

Type of Micro-organism	Limits	Test Methods
Aerobic plate count (APC),cfu/g, max	10 <sup>3</sup>	ISO 4833
Yeast and moulds, cfu/g, max	10 <sup>2</sup>	ISO21527-2
Staphylococcus aureus,cfu, per 25g,max	Not detectable	ISO 6888-1, 2 or 3
E. Coli, cfu/g, max	Not detectable	ISO7251
Salmonella, per 25g,max	Not detectable	ISO6579

## 9 Packaging

**9.1** Fortified milled maize products shall be packaged in containers which will safeguard the hygienic, nutritional, technological, and organoleptic qualities of the product.

**9.2** The containers, including packaging material, shall be made of substances which are safe and suitable for their intended use. They should not impart any toxic substance or undesirable odour or flavour to the product.

**9.3** Fortified milled maize products shall be packed in suitable packages which shall be clean, sound, free from insects and fungal infestation and the packing material shall be of food grade quality.

#### **9.4** Each package shall be securely closed and sealed.

NOTE 1: Packaging materials will be required to meet different regulations in the different destination Countries.

NOTE 2: The packages fill should conform to the requirements of the legal metrology of the destination country.

### **10. Labeling**

**10.1** In addition to the requirements of SLS4:2010 General standards for the packaging of pre-packaged foods, the following specific provisions apply:

- product name as " Whole Maize Meal, Sifted Maize meal, Maize flour or Granulated Maize meal"
- the word "fortified" shall be declared before the name of the product
- name, address and physical location of the producer/ packer/importer;
- Brand name/registered trade mark
- lot/batch/code number in code or in clear format
- net weight in metric units;
- storage instruction as "Store in a Cool Dry Place away from any contaminants";
- the declaration "Food for Human Consumption"
- instructions on disposal of used package;
- country of origin;
- date of manufacture
- best before date
- Expiry date or best before \_\_\_\_\_ month \_\_\_\_\_ year;
- Each product unit may also be marked with the national food fortification Logo, where the industry qualifies to use the mark.

#### **10.2 Nutrition labelling**

The names and the amount of the nutrients added in the fortified maize flour shall be declared on the label in accordance with CAC/GL2.

#### **10.3 Nutrition and health claims**

Fortified milled maize products may have claims on the importance of the added nutrients in nutrients and health. Such claims when declared shall be consistent with CAC/GL 1 and CAC/GL 23.

### **11. Sampling**

Sampling shall be done in accordance with the ISO 24333.

### **12. Methods of test**

Testing for micronutrients may be conducted using any internationally recognized test methods.