

## **Cereal and Pulses – Specification for Fortified Wheat Flour**

### **1. Scope**

This Sierra Leone Standard specifies requirements and methods of sampling and test for fortified wheat flour prepared from common wheat (*Triticum aestivum* L.), club wheat (*T.compactum* Host.) or a mixture thereof for direct 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 76: 2014 - Specification for wheat flour.
- 2.5** SLS 71: 2014 – Specification for wheat grain
- 2.6** SLS 35:2010 – Microbiological analysis of foods- Sampling plans and Microbiological Criteria
- 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 7251, Microbiology of food and animal feeding stuffs – horizontal method for the detection and enumeration of presumptive Escherichia coli – most probable number technique.
- 2.19** ISO 7254, Microbiology of food and animal feeding stuffs — General guidance for enumeration of yeasts and moulds – Colony count technique at 25° C.
- 2.20** ISO 24333, Cereals and Cereal products — sampling
- 2.21** 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
- 2.22** ISO20483, Cereals and Pulses – Determination of Nitrogen Content and Calculation of the Crude Protein – Kjeldahl Method
- 2.23** 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
- 2.24** ISO 6869, Animal feed stuff – Determination of the contents of Calcium, Copper, Iron, Magnesium, Manganese, Sodium ,Potassium and Zinc – Method using Atomic Absorption Spectrometry
- 2.25** 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 wheat flour**

means wheat flour to which nutrients 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

#### **3.5 food fortification**

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

#### **3.6 NaFeEDTA**

means sodium iron Ethylenediamine tetraacetic acid

## 4. Quality Requirements

### 4.1 Raw Materials

The wheat grain from which the flour is obtained shall be sound quality, free from sand, have characteristic odour and flavour complying with SLS XX: 20XX – Cereal and Pulses – Specification for wheat flour

### 4.2 General requirements

**4.2.1** fortified wheat flour shall have the characteristics colour and shall be free from any objectionable flavours and odours

**4.2.2** the flour shall be free from insects, worms, fungal infestation, rodent contaminations and foreign matter.

**4.2.3** the flour shall not contain flour from other cereals. However, the addition of malted barley flour not exceeding 1% is permissible in the case of baker's flour.

### 4.3 Specific requirements

The types of wheat flour shall comply with the compositional requirements given in Table 1 below.

**Table 1: Specific requirements for fortified Wheat Flour**

Parameter	Baker's Flour	Home Baking	Biscuit Flour	Cracker Flour	Self-raising Flour	Standard Flour	Atta flour	Whole meal flour	Method of test
Moisture content % m/m,	13	13	13	13	13	13	13	13	ISO 711 or ISO 712
Crude fibre content, % by mass, max	1.0	1.0	1.0	1.0	1.0	1.5	2.0	2.0	ISO 5498
Total ash content, % by mass, max	0.7	0.7	0.55	0.70	2.0	1.10	2.0	2.0	ISO 2171
Residue on sieving through 180 micron sieve, % by mass, max	0.8	0.8	0.5	0.5	0.8	30.0	55.0	30.0	AOAC 965.22
Protein content, % by mass, min	11.0	9.0	8.0	8.0	8.0	11.0	12.0	12.0	ISO 20483

### 4.4 Self-raising flour

In addition to the specifications in table 1 above, specific requirements for self-raising wheat flour may contain the following:

- Iodized salt conforming to **SLS 30: 2010 – Spices and Condiments – Specification for salt fortified with iodine**
- Acid ingredients which shall be one or any combination of the following:
- Sodium acid pyrophosphate;
- mono acid calcium phosphate;

- sodium aluminium phosphate; and
- sodium bicarbonate insufficient amounts to provide not less than 0.4 % of variable carbon dioxide.

## 5. Fortification requirements

### 5.1 levels of micronutrients

The wheat flour shall be fortified with all the micronutrient indicated using the fortificants shown, in such a way that the product conforms to the limits set in Table 2 below.

**Table 2: Requirements for levels of micronutrients in fortified Wheat Flour**

Nutrients	Fortificant compound	Recommended factory levels, mg/kg	Regulatory levels, mg/kg	
			Minimum	maximum
Vitamin A	Vitamin A (Retinol) palmite, spray-dried or equivalent, 0.075% retinol, min.	$1.0 \pm 0.4$	0.5	1.4
Vitamin B <sub>1</sub>	Thiamine Mononitrate, activity level, 81%,min	$9.8 \pm 4.4$	4.6	NA <sup>1</sup>
Vitamin B <sub>2</sub>	Riboflavin, activity level, 100%,min	$6.6 \pm 3$	3.3	NA <sup>1</sup>
Niacin	Niacinamide , activity level, 99%,min	$60 \pm 30$	30	NA <sup>1</sup>
Vitamin B <sub>6</sub>	Pyridoxine, activity level, 82%,min	$6.5 \pm 3.5$	3	NA <sup>1</sup>
Folate	Folic acid, activity level, 100%,min	$2.3 \pm 1$	1.1	3.2
Vitamin B <sub>12</sub>	Vitamin B <sub>12</sub> (water soluble,), activity level, 0.1%,min	$0.02 \pm 0.009$	0.01	NA <sup>2</sup>
zinc	Zinc oxide, activity level, 80%,min	$60 \pm 10$	40	80
Total iron	Total iron	$30 \pm 10$	20	NA <sup>1</sup>
Added iron	NaFeEDTA <sup>2</sup> , activity level, 13% Fe, min	$30 \pm 10$	20	40
	Ferrous fumerate <sup>2</sup> , activity level, 32%,min	$40 \pm 10$	30	50

<sup>1</sup> NA – Not applicable. The maximum limits for these nutrients are not necessary because the upper

tolerance limits of these nutrients are very high.

<sup>2</sup> the use of one of these would be considered.

Factories should aim at fortifying the products at the recommended factory level to ensure the product conforms to the regulatory levels throughout the distribution chain.

## 5.2 Fortificants

Fortificant for use 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)

**Note:** for the addition of iron, premix producers may either use NaFeEDTA at the levels provided, which should be tried first to test for compatibility with the flour and if low levels are needed, or the producer may use ferrous fumarate.

## 5.3 Premix

The fortificants may 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 FCC.

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 or Table 4 below when fumarate or NaFeEDTA is used respectively.

Where the premix is made in accordance with Table 3, the addition rate shall be 500 g of premix per metric tonne of wheat flour. Where the premix is made in accordance with Table 4, the addition rate shall be 600g of premix per metric tonne of wheat flour.

The premix shall be labelled with the addition rate (that is the amount of premix to be added to the wheat flour) in grams of premix per metric tonne of wheat flour and dilution factor.

**Note:** This premix formulation in Table 3 and Table 4 is designed with minimum nutrient composition and does not take into consideration factory overages in the preparations of the premix.

**Table 3 – Formulation of fortification mix for addition of vitamins and minerals to wheat flour if using ferrous fumarate as source of iron**

Nutrient	Fortificant compound	Amount of micronutrients to be added to wheat flour, mg/kg	Amount of fortificant to be added to wheat flour, mg/kg	Amount of fortificant in premix, g/kg premix	Amount of nutrients in premix, g/kg premix
Vitamin A	Vitamin A (Retinyl) palmitate, spray-dried or equivalent, 0.075% retinol, min.	1	13.3	26.7	2
Vitamin B <sub>1</sub>	Thiamine Mononitrate, activity level, 81%,min	9	11.1	22.2	18
Vitamin B <sub>2</sub>	Riboflavin, activity level, 100%,min	6	6.0	12.0	12
Vitamin B <sub>3</sub> (Niacin)	Niacinamide , activity level, 99%,min	50	50.5	101.0	100
Vitamin B <sub>6</sub>	Pyridoxine, activity level, 82%,min	6	7.3	14.6	12
Vitamin B <sub>9</sub> (folate)	Folic acid, activity level, 100%,min	2	2.2	4.4	4
Vitamin B <sub>12</sub>	Vitamin B <sub>12</sub> (water soluble,), activity level, 0.1%,min	0.02	20.0	40.0	0.04
Iron	Ferrous fumarate, a activity level, 32% Fe, min	40	125.0	250.0	80
Zinc	Zinc oxide, activity level, 80%,min	30	37.5	93.8	75
	Filling material (at least 25%)		68.2	317.5	
		<b>TOTAL</b>	<b>341.2</b>	<b>1000</b>	

**Table 4 – Formulation of fortification mix for addition of vitamins and minerals to wheat flour if using NaFeEDTA as source of iron**

Nutrient	Fortificant compound	Amount of micronutrients to be added to wheat flour, mg/kg	Amount of fortificant to be added to wheat flour , mg/kg	Amount of fortificant in premix, g/kg premix	Amount of nutrients in premix, g/kg premix
Vitamin A	Vitamin A (Retinol) palmitate, spray-dried or equivalent, 0.075% retinol, min.	1	13.3	26.7	2
Vitamin B <sub>1</sub>	Thiamine Mononitrate, activity level, 81%,min	9	11.1	22.2	18
Vitamin B <sub>2</sub>	Riboflavin, activity level, 100%,min	6	6.0	12.0	12
Vitamin B <sub>3</sub> (Niacin)	Niacinamide , activity level, 99%,min	50	50.5	101.0	100
Vitamin B <sub>6</sub>	Pyridoxine, activity level, 82%,min	6	7.3	14.6	12
Vitamin B <sub>9</sub> (folate)	Folic acid, activity level, 100%,min	2	2.2	4.4	4
Vitamin B <sub>12</sub>	Vitamin B <sub>12</sub> (water soluble,), activity level, 0.1%,min	0.02	20.0	40.0	0.04
Iron	NaFeEDTA, activity level, 13% Fe, min	30	230.8	461.5	60
Zinc	Zinc oxide, activity level, 80%,min	30	37.5	93.8	75
	Diluent (Filling material, at least 25%)		94.7	53.1	
		<b>TOTAL</b>	<b>473.4</b>	<b>1000.0</b>	

#### **5.4 Stability of fortificants and premixes**

The vitamin 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 wheat flour 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 may contain food additives in accordance with CODEX STAN 192.

## 7. Contaminants

### 7.1 Heavy metals

Fortified wheat flour shall be free from heavy metals in amounts which may represent a hazard to human health. Fortified wheat flour shall not contain metal contaminants exceeding the limits in Table 5

**Table 5: 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	
Iron	5.0	

### 7.2 Pesticide residues

Fortified wheat flour shall comply with those maximum residue limits provided in Table 6 below.

**Table 6: Maximum residue limit for fortified wheat flour**

Type	Unit	Limit	Note
Methyl bromide	mg/kg	0.01	(*)Po
Methyl bromide	mg/kg	1	Po

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

Po the MRL accommodate post-harvest treatment of the commodity

### 7.3 Mycotoxins

Fortified wheat flour shall not exceed total aflatoxin of 10µg/kg and 5 µg/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 7.

**Table 7: Microbiological limits for Fortified wheat flour**

Type of Micro-organism	Limits	Test Methods
Aerobic plate count (APC),cfu/g	$10^3$	ISO 4833
Yeast and moulds, cfu/g,	$10^2$	ISO21527-2
Staphylococcus aureus per 25 g	Not detectable	ISO6888
E. Coli, cfu/g, max	Not detectable	ISO7251
Salmonella, per 25 g, max	Not detectable	ISO6579
Coliforms g (per 100 g)	Not detectable	ISO 4832
Bacillus cereus, per 25 g, max	Not detectable	ISO 7932
Vibrio cholerae	Not detectable	ISO/TS 21872

## **9 Packaging**

**9.1** Fortified wheat flour 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 wheat flour 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: Packaging materials will be required to meet different regulations in the different destination countries.  
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 “ fortified wheat flour”.
- name, address and physical location of the producer/ packer/importer;
- lot/batch/code number
- net weight, in metric units;
- the declaration “Food for Human Consumption”
- storage instruction as “Store in a cool dry place away from any contaminants”;
- packing date;
- 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 wheat flour shall be declared on the label in accordance with CAC/GL2.

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

Fortified wheat flour 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.

