

NATIONAL STANDARDS FOR LOW- AND HIGH- EXTRACTION WHEAT FLOUR FORTIFICATION - EXAMPLES FOR DISCUSSION

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For effective solution of the problem of micronutrient deficiency in all levels of population primarily shall be fortified the consumer products available for adults and children, regularly used in their daily diet. The fortified food shall be usual for use and consumption of population, or at least its target groups. **These products include flour and bakery products, milk and dairy products,** sugar, salt, drinks, baby food products, fat products, meat and fat-based products.

Food fortification with vitamins and minerals must not impair the consumer properties of these products: reduce the content and availability of other nutrients, significantly change their taste, aroma, freshness of products, reduce their expiry date.

When fortification it is necessary to take into account the possibility of chemical interaction of fortificants with each other and product components, and to select those combinations, forms, methods and stages of addition that provide their maximum safety during production and storage.



NATIONAL STANDARDS

- Developed National Standards:
- «High extraction fortified wheat flour»
- «Low extraction fortified wheat flour»



DEFINITIONS

High extraction flour (coarse flour $\geq 80\%$ of wheat flour)



Low extraction flour (refined, low ground flour $\leq 80\%$ of wheat flour)

Primary product for fortified flour: the wheat fed to a mill shall meet the following requirements

Grain index	Standard, mg/kg, max.
The content of barley, rye grains and sprouted grains of these crops and wheat (in aggregate) including:	5.0
Sprouted grain	3.0
Corn cockle	0.1
Extraneous matters:	
Ergot	0.05
Creeping bitterling, <i>Sophora alopecuroides</i> , thermopsis lancet (in aggregate) including creeping bitterling and multicolored coronilla (in aggregate)	0.1
Coronilla	0.1
<i>Heliotropium dasycarpum</i>	0.1
<i>Trichodesma incanum</i>	Not allowed
Smut grain (dirty, blue-eyed mold corn)	10.0
Fusarium grain	1.0
Note: Content of sprouted grain shall be determined on analysis results before treatment.	

ORGANOLEPTIC AND PHYSICAL-CHEMICAL PARAMETERS OF THE LOW EXTRACTION FORTIFIED FLOUR

Parameter	Description and standard
Color	White or white with cream shade, or white with yellow shade
Taste	Common to the wheat flour, without other tastes, not sour, not bitter
Odor	Common to the wheat flour, without other odors, not stale (In the fortified flour allowed to have the faint smell of vitamins and supplements)
Moisture content, %, maximum	15.5
Presence of mineral impurities	No crunch by mastication
Metal magnetic admixture, mg per 1 kg of flour; size of individual particles in maximum linear dimension 0.3 mm and/or weight of no more than 0.4 mg, maximum	3.0
Grain products pests contamination (insects, mites)	Not allowed
Grain products pests contamination (insects, mites), total contamination density	Not allowed
Contamination of bread with potato disease agents (36 hours after test laboratory baking)	Not allowed

ORGANOLEPTIC AND PHYSICAL-CHEMICAL PARAMETERS OF THE HIGH EXTRACTION FORTIFIED FLOUR

Parameter	Description and standard
Color	White with yellow or grey shade
Taste	Common to the wheat flour, without other tastes, not sour, not bitter
Odor	Common to the wheat flour, without other odors, not stale
Moisture content, %, maximum	15.0
Presence of mineral impurities	No crunch by mastication
Metal magnetic admixture, mg per 1 kg of flour; size of individual particles in maximum linear dimension 0.3 mm and/or weight of no more than 0.4 mg, maximum	3.0
Grain products pests contamination (insects, mites)	Not allowed
Grain products pests contamination (insects, mites), total contamination density	Not allowed
Contamination of bread with potato disease agents (36 hours after test laboratory baking)	Not allowed

QYALITY REQUIREMENTS OR PARAMETERS OF LOW EXTRACTION FORTIFIED FLOUR

Parameter	Description and standard	
Ash w/w on dry basis, %, maximum	0.55-0.75	
Whiteness, s.u. of whiteness meter RZ-BPL, minimum	36.0-55.0	
Wet gluten w/w, %, minimum	28.0-30.0	
Wet gluten quality, s.u. of IDK device	Not lower than II group	
Grain of flour, %, maximum: - Oversize particles on GOST 4403, maximum	5 silk №43 or polyamide №45/50 PA or 2 silk №35 or polyamide № 36/40 PA	
- Undersize on GOST 4403	-	Not less than 80.0 made of silk №43 or of polyamide № 45/50 PA
Falling number, «FN», s, minimum	185	
Note: 1. Parameter “whiteness” replaces the parameter “ash content” on mills equipped with laboratory devices and machinery according to GOST 26361. 2. Parameter “Falling number” – FN is determined according to GOST ГOCT 27676, upon customer’s request. 3. To determine the grain of flour is allowable to use other mesh with equivalent sieving capacity.		

QUALITY REQUIREMENTS OR PARAMETERS OF HIGH EXTRACTION FORTIFIED FLOUR

Parameter	Description and standard	
Ash w/w on dry basis, %, maximum	1.25	
Whiteness, s.u. of whiteness meter RZ-BPL, minimum	12.0	
Wet gluten w/w, %, minimum	25.0	
Wet gluten quality, s.u. of IDK device	Not lower than II group	
Grain of flour, %, maximum: - Oversize particles on GOST 4403, maximum	2 silk №27 or polyamide №120 PA	
- Undersize on GOST 4403	-	No less than 65.0 of silk №38 or polyamide № 41/43 PA
Falling number, «FN», s, minimum	160	
Note: 1. Parameter “whiteness” replaces the parameter “ash content” on mills equipped with laboratory devices and machinery according to GOST 26361. 2. Parameter “Falling number” – FN is determined according to GOST ГОСТ 27676, upon customer’s request. 3. To determine the grain of flour is allowable to use other mesh with equivalent sieving capacity.		



The amount of vitamins and minerals added to the fortified flour shall be controlled **in the production process by feeding**, in accordance with formula regulating the weight of premix or pre-mixture to be added per unit weight of the flour stream to be fortified.

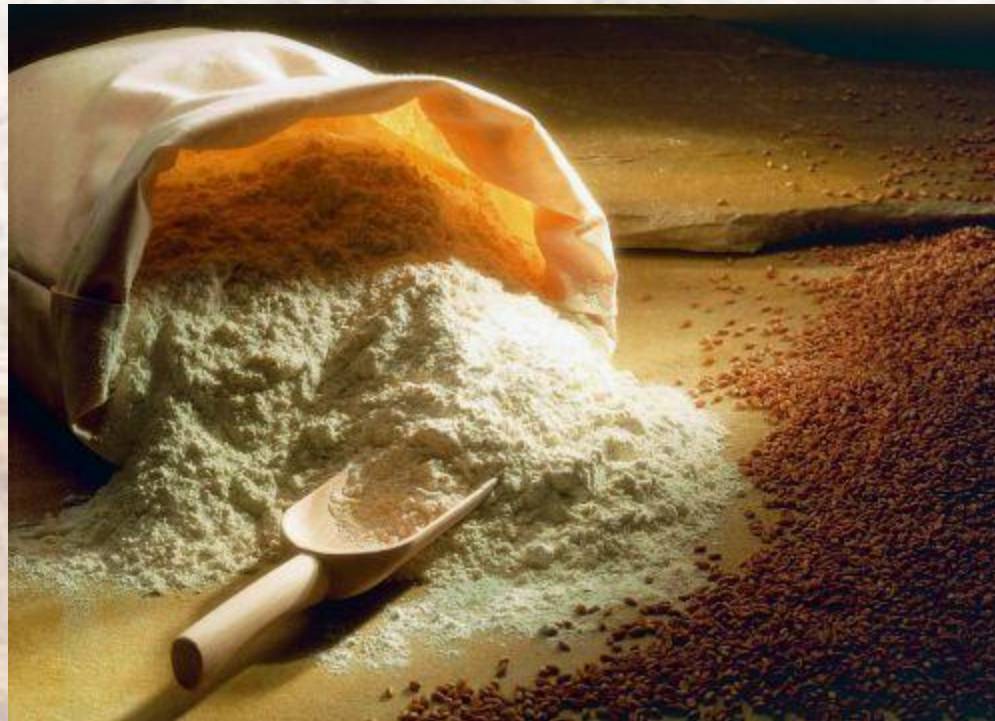
PERMISSIBLE LEVELS OF VITAMINS AND MINERALS IN THE LOW EXTRACTION FORTIFIED FLOUR

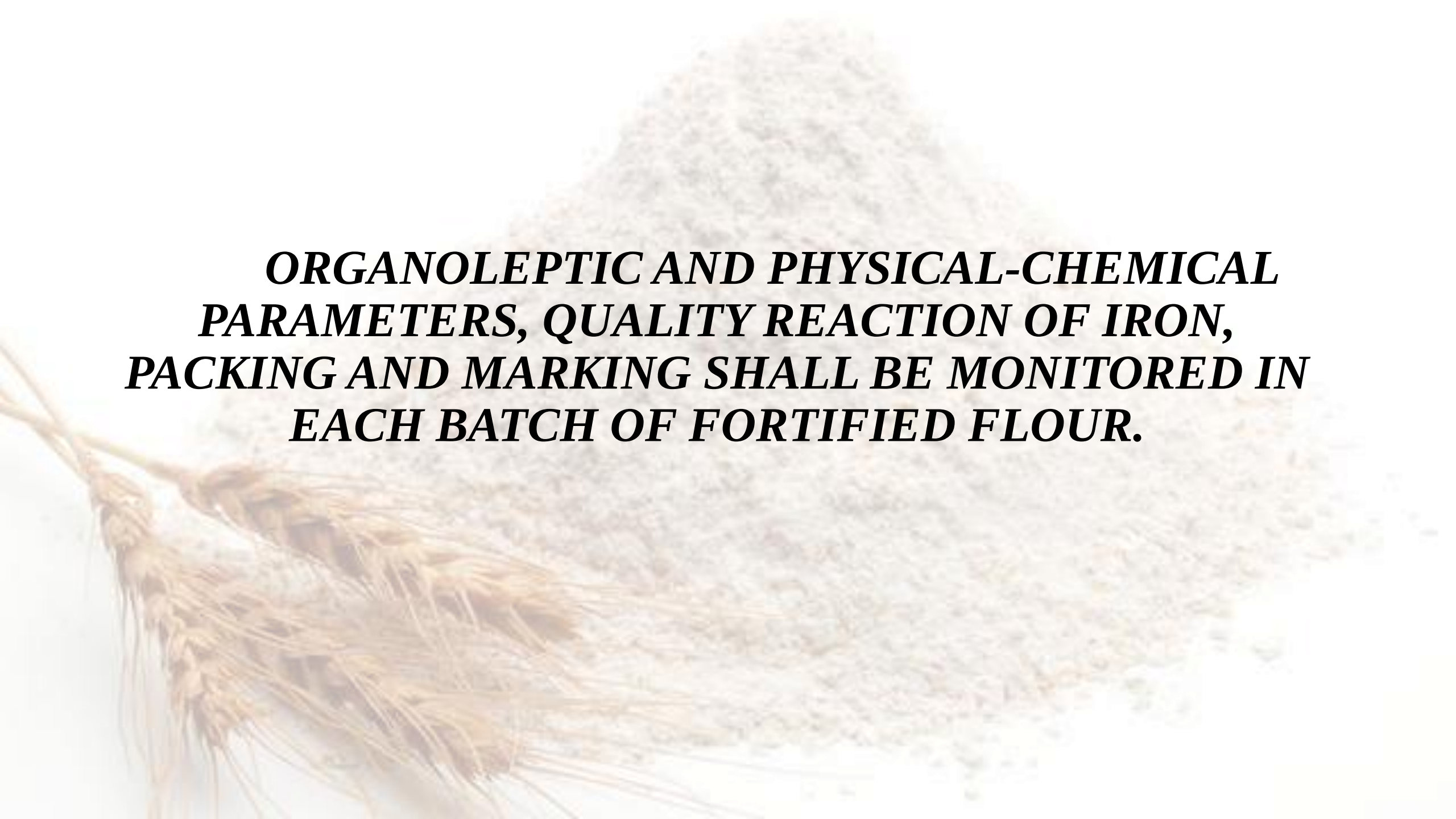
<u>Parameters</u>	<u>Mg per 1 kg of flour</u>
B12 (given background value)	0.002-0.006
B9 (given background value)	0.7-1.9
B1 (given background value)	1.5-4.1
B2 (given background value)	2,0-5.2
B3 (given background value)	11,0-29.0
W/w of iron (given background value): - NaFeEDTA	16.0-32.0
W/w of zinc (given background value)	26.0-50.0
Qualitative reaction of iron content	Positive
* the fortified flour may have a faint smell of vitamins and additives;	

PERMISSIBLE LEVELS OF VITAMINS AND MINERALS IN THE HIGH EXTRACTION FORTIFIED FLOUR

<u>Parameter</u>	<u>Mg per 1 kg of flour</u>
B12 (given background value)	0.004-0.012
B9 (given background value)	0.7-2.0
W/w of iron (given background value):	36.0-70.0
W/w of zinc (given background value)	40.0-78.0
Qualitative reaction of iron content	positive
* the fortified flour may have a faint smell of vitamins and additives; ** without added elemental electrolyte iron when fortifying (selected by sieve analysis from entire metal magnetic admixture of a sample).	

In terms of content of toxic elements, pesticides, mycotoxins and of microbiological parameters the fortified flour shall not exceed levels permitted by requirements of TR TS 021/2011 (On safety of food products).



A close-up photograph of a large, conical pile of fine white flour. In the lower-left foreground, a single stalk of golden-brown wheat is partially visible, its head resting near the base of the flour pile. The background is a soft, out-of-focus white.

***ORGANOLEPTIC AND PHYSICAL-CHEMICAL
PARAMETERS, QUALITY REACTION OF IRON,
PACKING AND MARKING SHALL BE MONITORED IN
EACH BATCH OF FORTIFIED FLOUR.***

Organoleptic control methods for fortified flour

Determination of odor, taste and crunch

To determine the odor of tested sample select a test portion of flour or bran of about 20 g, strew it on a clean paper, warm with breathing and set smell.

To activate the smell put the flour or bran test portion in a glass, douche with hot water of 60°C, drain water from the glass and smell the product.

Taste and crunch determine by chewing 1 – 2 flour test portions of about 1 g each.

Odor, taste and crunch are determined in accordance with parameters specified in standards for flour and bran.

In case of disagreements, the odor, taste and crunch in bakery and pasta flour shall be determined by tasting the bread baked from this flour.

The background of the slide features a soft-focus image of wheat stalks on the left side, with a large, light-colored pile of flour or fine grain dominating the center and right portions of the frame.

The mass content of fortificants (vitamins, iron and zinc) in fortified flour shall be determined in accordance with GOST methods and methods as approved.

Use spectrophotometric methods as well as gas and liquid chromatography methods

Quality reaction to confirm the iron content shall be determined according to the procedure specified in next screens.

• Marking

- On the bags, package and labels invested inside a package shall be marked:
- Products name;
- Manufactures name and location (legal adress, including country and doesn't match with the legal address, busines address) and organizations autorized by the manufactures to acept claims from consumers
- Trademark
- Net weight
- Information about the ingredients in the manner appropriate to their descending order by weight or percentage terms;
- Manufacturing date and expiry date
- Storage conditions
- Food and energy value
- Number of parties;
- Barcodes;
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Marking

On the bags, package shall be marked with the indication:

Products name;

Manufactures name and location (legal adress, enterprises and organization receiving complaints address;

Trademark

Net weight

Information about the ingredients;

Manufacturing date and expiry date

Storage conditions

Food and energy value

Number of parties;

Barcodes;

The background of the slide features a soft-focus image of wheat stalks on the left and a mound of white flour on the right, creating a rustic and agricultural theme.

- Marking

- **Additionally applied**

- large print word “fortified”;
- Standard Logo fortified products approved in the prescribed manner
- Registered trademark name premiuma or premix, used in the flour fortification and normative document on which they are made.
- On the group containers shall be marked with above details, and further specifies the number of consumer packages;

- **Transport marking**

- The information may be placed in one or more convenient places for reading. The information can be applied in any way and should be clear and easy to read.
- Text and labels applied to the State and Russian languages, or the language of the customer under the contract

Packing and marking of fortified wheat flour

The fortified flour shall be packed and marked in accordance with applicable standard requirements. At the same time, together with specified requirements to package and marking, shall be applied the additions to marking of containers for fortified flour.

This addition is the standardized mark – Logo – developed by the Kazakh Academy of Nutrition. The logo «healthy food» can be applied to all kinds of fortified products. In particular, for the fortified wheat flour.

It is necessary to follow the terms of use for certification mark, because only in this case the mark will act as necessary – create awareness of consumers, satisfaction and confidence in products quality. The recommended combination of colors makes the certification mark visible and clear.

Rules relating to certification mark:

1. If possible, the mark shall be printed in red on white background.
2. If the background is not pure white, but provides enough contrast (natural white color), use logo in red.
3. If the background does not harmonize with red color of the logo, choose one of the following solutions:
 - place the red mark on white rectangle,
 - use a white sign,
 - see recommendations for usage the certification mark.



healthy food
сапалы азық

Transportation and storage

Transportation and storage of fortified flour

The fortified flour can be transported by all transportation means in accordance with freight regulations applied for corresponding means of transport, with presence of duly executed sanitary passport for this transport.

The fortified flour shall be stored in dry place, under temperature not higher than 25°C and average humidity not more than 70%, without direct sunlight.

Manufacturer's guarantee

Manufacturer guarantees the compliance of the fortified flour with requirements of this standard, if the consumer observes the storage and transportation requirements.

Best before 12 months from the date of production.

Nutrition and energy value of the fortified flour per 100 g of product

Proteins, g	Fat, g	Carbohydrates, g	Energy value
10.3-10.6	1.1-1.3	68.9-67.6	334-331 kcal 1398-1385 kJ

QUALITATIVE METHODS OF DETERMINATION OF IRON IN FLOUR

PRINCIPLE

Ferric iron in acidic media reacts with potassium thiocyanate solution (KSCN) and forms the insoluble red color. Other types of iron like ferrous and elemental iron can also react similarly with oxidizing to ferric iron by means of hydrogen peroxide. **Presence of electrolyte or reduced iron** can be determined visually by placing a magnet in the flour sample and drawing of iron particles to it.

Ferrous iron can be identified by creating insoluble light-blue color called Turnbull's blue or Berlin blue by reaction with ferrocyanide. Reaction occurs very quickly with ferrous sulfate, but can be slow or even not occur with ferrous fumarate due to low solubility of this salt in water. Reaction can also occur with electrolyte iron after oxidation of iron to Fe^{2+} , but the rate of reaction is very low.

MATERIALS

- Filter Whatman paper № 1
- Hand sieve
- Watch glass

REAGENTS

- 2N HCl Hydrochloric acid solution. In 200 ml flask add 100 ml of distilled water. Then slowly add 17 ml of concentrated HCl, then add 83 ml of water.
- Hydrochloric acid solution- 0.003N (HCl). In 1 liter volumetric flask add 600 ml of distilled water, add 1.5 ml of 12N HCl- and make to volume with distilled water.
- Potassium tiocyanate-10%. Dissolve 10 g of KSCN in 100 ml of water. Before use mix 10 ml of this solution with 10 ml of 2N HCl.
- Hydrogen peroxide (H₂O₂) - 3% (required if the fortification is being made with elemental iron). In 50 ml flask add 5 ml of concentrated 30% H₂O₂ and make to volume of 45 ml with distilled water. To prepare daily, discard after finished tests.
- Potassium ferricyanide-10%. Dissolve 10 g of K₃Fe(CN)₆ in 100 ml of water. Before use mix 10 ml of this solution with 10 ml of 0.003N HCl.

PROCEDURE

Determination of iron in samples containing elemental iron (electrolyte, reduced iron and other)

1. Take a magnet and put it into 1 kg flour sample.
2. Move the magnet inside the sample, then remove it.
3. The presence of electrolyte or reduced iron is confirmed by presence of small particles of iron on the magnet.

Determination of iron in samples containing NaFeEDTA

1. Place the filter paper on a watch glass.
2. Wet the paper surface with potassium thiocyanate solution. The liquid shall infiltrate the paper.
3. By means of hand sieve sift a portion of flour sample so that a thin flour level cover the wet filter paper, remove the excessive flour.
4. Add to the flour surface the acidic solution of potassium thiocyanate, wait a few minutes until reaction.
5. Red spots indicate the presence of iron salt, particularly NaFeEDTA.

Determination of other iron sources including elemental iron

1. Put the filter paper on the watch glass.
2. Wet the paper surface with potassium thiocyanate solution. The liquid shall infiltrate the paper.
3. By means of hand sieve sift a portion of flour sample so that a thin flour level cover the wet filter paper, remove the excessive flour.
4. Over the flour add a few of acidic potassium thiocyanate solution, wait for some minutes.
5. Add a small quantity of H_2O_2 solution, wait a few minutes until reaction (formation of iron (III)).
6. Red spots indicate the presence of added iron. (Note: If the result for electrolyte or reduced iron is negative in tests with magnet, so more likely is added the iron in form of ferrous salt).

Demonstration of presence of ferrous salt (mainly ferrous sulfate)

1. Place the filter paper on the watch glass.
2. Wet the surface of filter paper with potassium ferricyanide solution-10% and 0.003 N-HCl. The liquid shall infiltrate the filter paper.
3. By means of hand sieve sift a portion of flour sample so that a thin flour level cover the wet filter paper, remove the excessive flour.
4. Add a few of acidic solution of potassium ferricyanide over the flour.
5. Allow to stay a few minutes until reaction. Rapid reaction with clearly visible spots (during 2 minutes after addition of ferricyanide) indicates the presence of ferrous sulfate. Ferrous fumarate and some types of elemental iron also can have this reaction, but slowly (6-7 minutes and more). Elemental forms can be identified by procedure with magnet. For light brown-green spots the reaction for NaFeEDTA is positive.

Clarification

Number of spots and their homogenous distribution shows the concentration of iron and homogeneity of sample. For comparative evaluation use samples with known amount of the same type of iron as a control sample.

Laboratory monitoring of flour fortification process

Current process monitoring of finished fortified baking flour at mill is performed **only for presence of iron** added to the flour.

For process monitoring of flour fortification at mill is provided periodical weighing of premix or vitamin-mineral flour pre-mixture supplied by the feeder in time unit.

Periodically, once per quarter (or from each large batch) at mill samples of fortified flour shall be taken and sent for quantitative assessment of additives **only for iron**.

According to test results, if necessary, correct the rate of actual premix addition to the flour at this mill.



THANK YOU FOR ATTENTION!