
प्रबलित चावल दाना — विशिष्टि

Fortified Rice Kernels —
Specification

ICS 67.060

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Foodgrains, Allied products and Other Agricultural Produce Sectional Committee had been approved by the Food and Agriculture Division Council.

Fortified rice kernels (FRK) are rice grains fortified with micronutrient premix. The micronutrient premix is added to rice-based carrier to form fortified rice kernels using two technologies namely, extrusion and coating. Fortified kernels are blended with non-fortified rice in a ratio of 1 percent or 2 percent to produce fortified rice. In order to overcome micronutrient deficiencies in Indian population, Government of India is promoting consumption of fortified rice containing iron, folic acid and vitamin B₁₂, through various social security programmes like Public Distribution System (PDS), Integrated Child Development Services (ICDS), and National Programme of Mid-Day Meal in Schools (MDMS). Accordingly, the committee decided to formulate an Indian Standard on specification for fortified rice kernels to ensure its quality.

In the formulation of this standard, due consideration has been given to the provisions of the *Food Safety and Standards Act, 2006* and the Rules framed thereunder and the *Legal Metrology (Packaged Commodities) Rules, 2011*. However, this standard is subject to the restrictions imposed under these, wherever applicable.

The composition of the Committee responsible for formulation of the standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

FORTIFIED RICE KERNELS — SPECIFICATION

1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for fortified rice kernels.

2 REFERENCES

The standards given below contain provisions which, through reference in this text, constitute provisions of this 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 editions of these standards.

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
		5402 (Part 1) : 2021/ ISO 4833-1 : 2013	Microbiology of the food chain — Horizontal method for the enumeration of microorganisms: Part 1 Colony count at 30 °C by the pour plate technique
		5403 : 1999	Method for yeast and mould count of foodstuffs and animal feeds (<i>first revision</i>)
460 (Part 1) : 2020	Test Sieves — Specification: Part 1 Wire cloth test sieves (<i>fourth revision</i>)	10500 : 2012	Drinking water — Specification (<i>second revision</i>)
1070 : 1992	Reagent grade water — Specification (<i>third revision</i>)	14818 : 2017/ ISO 24333 : 2009	Cereal and cereal products sampling (<i>first revision</i>)
2491 : 2013	Food hygiene — General principles — Code of practice (<i>third revision</i>)	16639 : 2018/ ISO 20633 : 2015	Infant formula and adult nutritionals — Determination of vitamin E and vitamin A by normal phase high performance liquid chromatography
4333 (Part 1) : 2018	Methods of analysis for foodgrains Refractions (<i>third revision</i>)	16640 : 2018/ ISO 20634 : 2015	Infant formula and adult nutritionals — Determination of vitamin B ₁₂ by reversed phase high performance liquid chromatography (RP-HPLC)
(Part 2) : 2017/ ISO 712 : 2009	Determination of moisture content (<i>second revision</i>)		
(Part 3) : 2018/ ISO 7971-3 : 2009	Determination of bulk density, called mass per hectolitre (<i>second revision</i>)	17781 : 2021	Vitamin and mineral premix for manufacturing fortified rice kernels — Specification
(Part 4) : 2017/ ISO 520 : 2010	Determination of the mass of 1 000 grains (<i>second revision</i>)	EN 14164 : 2014	Foodstuffs — Determination of vitamin B ₆ by high performance chromatography
5401 (Part 1) : 2012/ ISO 4832 : 2006	Microbiology of food and animal feeding stuffs — Horizontal method for the detection and enumeration of coliforms: Part 1 Colony count technique (<i>second revision</i>)		

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Fortified Rice Kernels (FRK) — Rice shaped kernels containing vitamins and minerals produced through extrusion or whole rice kernels coated with vitamins and minerals.

3.2 Fortified Rice — Blend of fortified rice kernels and polished raw or parboiled rice in the ratio of 1 : 100 or 2 : 100.

3.3 Vitamin and Mineral Premix (VMP) — A combination of micronutrients (vitamins and minerals) in desired proportion ready for use as fortificant in the manufacturing of fortified rice kernels.

4 REQUIREMENTS

4.1 Description

4.1.1 Fortified rice kernels shall resemble the milled rice as closely as possible in final attributes, including shape, size (length, breadth, and thickness), thousand kernel weight [see IS 4333 (Part 4)], bulk density [see IS 4333 (Part 3)], true density, colour, flavour, and shall be free from off odour.

4.1.2 The variation in the physical characteristics of fortified rice kernels such as length, breadth, thickness, thousand kernel weight, and true density shall be within 10 percent when compared to the rice variety in which it is to be blended.

4.1.3 Fortified rice kernels shall contain micronutrients in levels as given in Table 1.

4.1.4 Fortified rice kernels may optionally contain micronutrients in levels as given in Table 2.

4.1.5 The fortified rice kernels shall keep the nutrients intact as specified in Table 1 and Table 2 even after cleaning, washing and cooking.

4.1.6 Fortified rice kernels shall be free from added colouring matter, metal peices and other impurities except the limits specified in Table 3.

4.2 Ingredients

Fortified rice kernels shall be prepared by using the following ingredients:

- a) *Rice Flour* — Clean broken rice at an initial moisture content of 11 to 12 percent, when tested as per method given in IS 4333 (Part 2), is ground to flour having an average particle size of less than 250 microns (preferably less than 150 microns). Rice flour is very hygroscopic in nature; hence, the raw material and final produce shall be handled to control moisture as per Good Manufacturing Practices (GMP)/Good Hygienic Practices (GHP) given in Annex B.
- b) *Vitamin and Mineral Premix* — Composition of vitamin and mineral premix shall conform to the recommended specifications given in IS 17781.
- c) *Additives* — Permitted food grade emulsifiers/hydrocolloids/binding agents/acid regulators/antioxidants shall be used as per the allowances

Table 1 Requirements for Level of Fortification (Mandatory Micronutrients)

(Clauses 4.1.3, 4.1.5 and 8)

Sl No.	Micronutrient	Chemical Form of Micronutrient	Fortification Level for 1 : 100 Blending Ratio	Fortification Level for 2 : 100 Blending Ratio	Method of Test, Ref to
(1)	(2)	(3)	(4)	(5)	(6)
i)	Iron, mg/100 g	Micronized ferric pyrophosphate OR; Sodium iron (III) ethylenediamine tetraacetate trihydrate (sodium feredetate- NaFeEDTA)	280 to 425 140 to 212.5	140 to 212.5 70 to 106.25	AOAC 944.02 or AACC 40-70.01 (total iron present in ferric form) by Atomic Absorption Spectrophotometry or AOAC 984.27 (using ICP Emission)
ii)	Folic acid, µg/100 g	Folic acid	750 to 1 250	375 to 625	AOAC 992.05 or EN 14131 (using microbiological extraction)
iii)	Vitamin B ₁₂ , µg/100 g	Cyanocobalamine or hydroxycobalamine	7.5 to 12.5	3.75 to 6.25	IS 16640

NOTE — Approved International standard test methods from organizations like ISO/APHA/ASTM/APAC/EPA/EN may also be followed

Table 2 Requirements for Level of Fortification (Optional Micronutrients)
(Clauses 4.1.4, 4.1.5 and 8)

SI No.	Nutrient	Chemical Form of Nutrient	Fortification Level for 1 : 100 Blending Ratio	Fortification Level for 2 : 100 Blending Ratio	Method of Test, Ref to
(1)	(2)	(3)	(4)	(5)	(6)
i)	Zinc, mg/100 g	Zinc oxide (ZnO)	100 to 150	50 to 75	AOAC 984.27 (using ICP emission spectroscopy) or AACC40-70.01 (using atomic absorption)
ii)	Vitamin A, µg/100 g	Retinyl palmitate	5 000 to 7 500 RE	2 500 to 3 750 RE	IS 16639
iii)	Thiamine (Vitamin B ₁), mg/100 g	Thiamine hydrochloride, or thiamine mononitrate	10 to 15	5 to 7.5	AOAC 2015.002 or AACC 86-80.01 (Total thiamin, thiamin phosphate, thiamin diphosphate, and thiamin triphosphate)
iv)	Riboflavin (Vitamin B ₂), mg/100 g	Riboflavin, or riboflavin 5'-phosphate sodium	12.5 to 17.5	6.25 to 8.75	J.AOAC Int. 2009;680-687
v)	Niacin (Vitamin B ₃), mg/100 g	Nicotinamide, or nicotinic acid	125 to 200	62.5 to 100	AOAC 2015.003 or AACC 86-90.01
vi)	Pyridoxine (Vitamin B ₆), mg/100 g	Pyridoxine hydrochloride	15 to 25	7.5 to 12.5	EN 14164

NOTE — Approved International standard test methods from organizations like ISO/APHA/ASTM/APAC/EPA/EN may also be followed

Table 3 Requirements for Fortified Rice Kernels
(Clause 4.1.6 and 8)

SI No.	Parameter	Specification	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Moisture content, percent by mass, <i>Max</i>	12.0	IS 4333 (Part 2)
ii)	Broken fortified rice kernels, percent by mass, <i>Max</i>	1.0	IS 4333 (Part 1)
iii)	Foreign matter, percent by mass, <i>Max</i>	0.001	Annex A
iv)	Damaged grains	Absent	IS 4333 (Part 1)
v)	Discolored grains	Absent	IS 4333 (Part 1)
vi)	Chalky grains	Absent	IS 4333 (Part 1)
vii)	Admixture	Absent	IS 4333 (Part 1)

prescribed under *Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011*.

- d) *Water* — Potable water as per IS 10500 shall be used for preparation of fortified rice kernels.

4.3 Pesticides/insecticides residues, poisonous metals, naturally occurring toxic substances and other contaminants (if any) in fortified rice kernels shall not exceed the limit as prescribed in the *Food Safety and Standards (Contaminants, Toxins and Residues) Regulations, 2011*.

4.4 Fortified rice kernels shall be manufactured in premises built and maintained under hygienic conditions (see IS 2491) following GMP/GHP protocols specified in Annex B.

4.5 Cooking Quality

4.5.1 Percent solid loss after cooking shall be less than 10 percent.

4.5.2 Cooking time shall be within 10 percent deviation to milled rice to which it is to be blended when tested as per method given at Annex C.

4.5.3 Texture of the cooked fortified rice kernel shall be similar to cooked unfortified rice in which it is to be blended when tested using texture profile analyzer.

4.5.4 Nutritional retention in cooked fortified rice kernels shall be more than 90 percent for iron, 80 to 60 percent for folic acid and more than 60 percent for vitamin B₁₂.

4.6 Storage

4.6.1 Fortified rice kernels shall be stored at room temperature (25 °C or less, RH < 60 percent) in a well-ventilated area and away from direct sunlight. Bags shall be stacked on pellets at least 1.5 m away from the wall.

4.6.2 The stocks shall operate on the first-in, first-out method.

4.6.3 Storage life shall be upto 12 months minimum.

4.7 In addition to above, fortified rice kernels shall conform to microbiological requirements specified in Table 4.

Table 4 Microbiological Requirements
(Clause 4.7 and 8)

Sl No.	Parameter	Specification	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Total plate count, cfu/g, <i>Max</i>	10 000	IS 5402 (Part 1)
ii)	Yeasts and moulds, cfu/g, <i>Max</i>	100	IS 5403
iii)	Coliform count, cfu/g, <i>Max</i>	10	IS 5401 (Part 1)

5 PACKING

5.1 The product may be packed in coextruded laminates to protect the fortified rice kernels from moisture and rodents. The packaging material shall be food grade non-reactive, non-transparent, water-resistant, and impermeable to oxygen, carbon dioxide and other gases.

5.2 The product shall be packed in quantities as stipulated under the *Legal Metrology (Packaged Commodities) Rules, 2011* as well as in accordance with requirements under the *Food Safety and Standards Act, 2006* and the Rules framed thereunder.

6 MARKING

6.1 The ink used for marking shall be of such quality which may not contaminate the product. Each package shall be suitably marked legibly and indelibly to give the following information:

- Name and address of the manufacturer;
- Date of packing;
- Lot/batch number;
- Net quantity;
- List and levels of the micronutrients and their chemical form;
- Storage instruction;
- Instruction for usage (intended level of blending 1 : 100 or 2 : 100);
- Not for retail sale;
- Best before.....month.....year; and
- Any other information required under the *Legal Metrology (Packaged Commodities) Rules, 2011, the Food Safety and Standards (Labelling & Display) Regulations, 2020*.

6.2 Fortified rice kernels manufacturer should provide a Certificate of Analysis of the product with the package.

6.3 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

7 SAMPLING

Representative samples of the material for ascertaining conformity to the requirements of this standard shall be drawn according to the method given in IS 14818.

8 TESTS

8.1 All the tests shall be carried out as specified in *col 6* of Table 1, *col 6* of Table 2, *col 4* of Table 3 and *col 4* of Table 4.

8.2 Quality of Reagents

Unless specified otherwise, pure chemicals shall be employed in tests and distilled water (*see* IS 1070) shall be used where the use of water as reagent is intended.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the test results.

ANNEX A

[Table 3, Sl No. (iii)]

DETERMINATION OF FOREIGN MATTER (ORGANIC AND INORGANIC)

A-1 APPARATUS

A-1.1 Physical Balance, 1 mg sensitivity.

A-1.2 Sieves — The following four IS Sieves of round holes shall be used [see IS 460 (Part 1)]:

	<i>IS Sieve</i>
Top	4.00 mm
Second from top	3.35 mm
Third from top	1.70 mm
Fourth from top	1.00 mm

A-1.2.1 A solid bottom pan shall be used at the bottom.

A-2 PROCEDURE

For the purpose of reducing the quantity of the test sample, spread the entire sample in a tray, divide it into four equal portions, collect the two opposite portions and repeat this process till the required quantity of sample is obtained.

Take 250 g of sample. Pour the quantity over the set of sieves previously arranged in a way so that the sieve with the largest perforations comes at the top and those with smaller perforations are placed in order of their sizes. Then, agitate the sample thoroughly to strain out the foreign matter at various levels. As a result of this straining, other foodgrain and foreign matter like bigger pieces of clay, chaff, etc., would remain on the first three sieves according to their sizes. The topmost sieve would contain bold grains, big pieces of clay and other big sized foreign matter, while the lower sieves would contain smaller foreign matter. Separate the sieves after straining and pick up all foreign matter by hand or forceps from each of them and add it to the foreign matter collected on the bottom pan.

Put the entire foreign matter collected as above into a beaker containing carbon tetrachloride. The inorganic extraneous matter will settle down which can be separated from the organic foreign matter. Remove the organic foreign matter, dry and weigh. Calculate the percentage. Remaining amount shall be the inorganic foreign matter.

ANNEX B

[Clause 4.2(a) and 4.4]

GMP/GHP PROTOCOLS FOR MANUFACTURING FORTIFIED RICE KERNEL (FRK)

B-1 RECEIPT OF RAW INGREDIENTS

B-1.1 Procedure

Inspect the condition of the package and ensure there is no damage to the package. Make sure the package is clean and no foreign material is present that may contaminate the material. Collect the shipping document and confirm the supplier name, product name, number of items as per purchase order (PO) and count the item physically. Collect the certificate of analysis (COA) of the product.

B-1.1.1 Entries of following information shall be made in the “Raw Material Lab Register”:

- PO number;
- Name of material and description;

- Date of receipt;
- Date of manufacturing
- Date of expiration
- Batch number;
- Weight of the material (as per PO and actual received) ;
- Suppliers details;
- Receivers details
- Transporter details (courier service); and
- Food grade certificates of vitamin and minerals premix and additives used.

B-1.1.2 Following quality control checks shall be done:

- Damaged or broken package and infestation or contamination shall be checked;

- b) Check the Certificate of analysis (COA);
- c) Check the composition of the material (see the specifications in COA);
- d) Draw the sample for testing in the laboratory and record the date and time; and
- e) Confirm the composition of material after laboratory analysis.

B-1.1.3 If the material is within the ordered specification, accept the material. Otherwise, reject it stating out of specification. Store the accepted material in the storage condition as stated by the supplier. Discard the rejected material and record the same in the QC register, and report to the supplier.

B-1.2 Specifications of Ingredients

Raw Ingredients	Potential Hazard	Critical Limit/ Specification
Broken rice	Moisture content	12 percent, <i>Max</i>
	Foreign bodies	Nil
	Insect infestation	Nil
	<i>Microbial</i>	
	Total plate count	100,000 cfu/g, <i>Max</i>
Vitamin and Mineral Premix (VMP)	Yeast and mold count	1000 cfu/g, <i>Max</i>
	Appearance	As per the specifications given in IS 17781
	Colour	
	Odour	
	Micronutrient content	
	The particle size of micronized ferric pyrophosphate	
Additives	Composition	As stated in COA

B-2 STORAGE OF RAW INGREDIENTS AND FINISHED PRODUCT

B-2.1 Broken Rice

The broken rice should be stored at ambient temperature and relative humidity of less than 60 percent in the dedicated area in the storage room. Inspect the storage room for any pest and rodents infestation. Mark the space in the raw material storage room for broken rice, VMP and other necessary ingredients. Use a plastic or wooden pallet to store the broken rice bags. Do not keep bags on the floor directly. Stacking of the bags should

be done in such a way as to facilitate maximum airflow or maintain aeration. The storage room should be equipped with rodent traps and pest-o-flash to control rodents, insects and pests. Make the storage area free from cracks and holes in the wall, floor, and sealing to avoid water seepage from any means. The storage area should be protected from moisture, rain, insect, pest, rodents, birds and fire, etc. Proper air ventilation should be maintained. The storage area should be kept dry and clean. Periodic fumigation of the storage room should be carried out. Broken rice shall be packed in biaxially oriented polypropylene (BOPP) laminated woven bags (25 kg capacity).

B-2.2 Vitamin and Mineral Premix

A dedicated cold storeroom/refrigerator is required for the storage of the VMP. The storage area should be free from any infestation such as pests, insects or rodents. The storage condition as mentioned by the VMP supplier should be adopted. If the VMP is stored in the containers, then the containers should be free from small and large openings to prevent insect, pest and foreign matter infestation. Storage container should be properly cleaned, disinfected, sanitized or fumigated with approved chemicals. Storage container should be water-resistant and airtight. For detailed specifications of vitamins and mineral premix, refer IS 17781.

B-2.3 Fortified Rice Kernels (FRK) and Fortified Rice

The preliminary requirements of the storage room are similar to the broken rice.

B-3 GRINDING OF BROKEN RICE

B-3.1 Procedure

The broken rice bag should be properly handled from storage to the processing room. The initial moisture content of broken rice should be less than 12 percent (w/w). Broken rice should be initially cleaned for metals, stone, plastic or paper, etc., before feeding to the grinder. Cleaning operation includes removing impurities through sieving operation, stones using de-stoner, and metal impurities using a magnetic separator. Check overall cleanliness of the micro-pulverizer (hopper, grinding housing, screen, and hammer), flour collecting bag, and container for broken rice and ensure that the nut-bolt of the grinding housing and hopper are properly tightened. In batch processing, weigh the requisite quantity of broken rice as per the batch requirement, transfer it to the hopper, and cover it with a lid to avoid contamination. Tie the properly cleaned flour collecting bag for the collection of flour. The bag should be carefully tightened so that the flour particles do not disperse in the processing room. Start the micro-pulverizer to grind broken rice into the flour having an average particle size of less than 250 microns

(preferably less than 150 microns). Monitor the grinding process and check the hopper for completion of the grinding process. Transfer the rice flour from the bag to the stainless steel container and keep it at room temperature to remove the heat of grinding before mixing the VMP. In continuous processing, monitor the broken rice and the rice flour flow rate as per the desired capacity.

B-3.2 Specification of Rice Flour

Moisture content shall be less than 12 percent and particle size of the rice flour should be less than 250 microns (preferably less than 150 microns).

B-3.3 Potential Hazards and Remedies

Potential Hazards	GMP/ CCP	Remedies
Incorrect weighing of broken rice or incorrect flow rate	GMP	Periodic validation and testing of weighing balance and flow rate.
Metal piece in the rice flour	GMP/ CCP (Critical Control Points)	Proper cleaning and maintenance of the grinder/micro-pulverizer. Routine check to confirm no screen damage and no metal on the screen. Properly tighten all nut-bolt of the machine.
Improper particle size	CCP/ GMP	Check the flow rate of broken rice and size of the screen in the grinder housing. Check to confirm no screen damage.

B-4 MIXING OF RICE FLOUR, VMP, ADDITIVES AND CONDITIONING

B-4.1 Procedure

Check the overall cleanliness of the mixer and ensure all the parts are properly tightened. Ensure that the mixing element (paddle or ribbon), mixing chamber, water spray tube, and cover lid are properly cleaned. Check the cleanliness of the water flow meter and the connecting pipe from the water reservoir to the mixer. Ensure that no metal to metal contact takes place during the mixing. Load the requisite quantity of rice flour, VMP and additives in the mixer and run for dry mixing of the ingredients for a specified duration. Spray the requisite amount of water in the mixer to condition the blend and run it for a specified duration for uniform distribution of moisture and allow the

wet blend to rest in the container for appropriate time period for conditioning. Transfer the conditioned blend for the extrusion. Micronutrients shall be distributed uniformly in the wet rice flour and VMP blend.

B-4.2 Potential Hazards and Remedies

Potential Hazards	GMP/ CCP	Remedies
Improper mixing (non-uniform distribution of micronutrients)	GMP CCP	Set predetermined mixing speed and time, and water flow rate.
Metal to metal contact	CCP	Routine check and properly tighten all parts.
Improper conditioning	CCP/ GMP	Proper mixing and water spraying.

B-5 EXTRUSION OF WET RICE FLOUR AND VMP BLEND

B-5.1 Procedure

Check overall cleanliness of feeding hopper, feeding screw, barrel, die head section and its cover, die, and cutter assembly of the twin-screw extruder (TSE). Ensure that the nut bolts of the extruder barrel are properly tight. Ensure that the electric connections of the heaters of the barrel and die head are alright. Ensure that the die is properly cleaned and the rice openings are open. Check the die thread and die head threads are properly cleaned. Set the TSE for the production with optimum process parameters (temperature, screw speed, feed rate and cutter speed). Monitor the set process parameters of the extruder in the control panel and the computer system. Prepare the TSE for the operation. Set the die and cutter assembly, connect the laptop/computer to the control panel; make ready the cooling arrangement, and switch on the TSE one hour before the operation to stabilize the temperature of each barrel zone. Set all the temperatures of the barrel heating zones (HZ) and die head zone as per the optimum condition, set the cooling temperature and start the water flow. Wait until all the temperature is set and stabilized. Set the speed of the feeder screw, extruder screw, and cutter. Start the data logging operation in the computer system. Feed the wet rice flour blend to the feeder hopper. Start the extruder screw followed by the feeder screw and cutter. Collect the preliminary extruded material and kept it aside. Adjust the cutter speed as per the requirement of the thickness of FRK. Collect the FRK in the stainless steel container and cover it with the lid or spread uniformly in a thin layer (single kernel) for drying. Measure the moisture content of the wet FRK.

B-5.2 Potential Hazards and Remedies

Potential Hazards	GMP/CCP	Remedies
Incorrect heating	CCP/GMP	Check the heater temperature and set it as per the standard operating procedure (SOP). Check the cooling system.
Incorrect feed rate	CCP/GMP	Check the feed rate and set it as per the SOP.
Incorrect cutting	CCP/GMP	Align the cutter and die properly.
Improper kernel weight	GMP	Check and adjust the cutter speed.
Kernel expansion	CCP	Check and control the barrel/die temperature.

B-6 DRYING OF EXTRUDED FORTIFIED RICE KERNELS**B-6.1 Procedure**

Check the overall cleanliness of drying trays in batch dryer and conveying belts in the continuous dryer. Ensure that the air heater and cooler, blower, airflow meter/rotameter, temperature sensors and relative humidity sensors are well working. Check the initial moisture content of the wet FRK. Spread the FRK in a thin layer (preferably a single kernel) in the tray or on the belt to achieve uniform drying of the kernels. Set the temperature, air velocity and relative humidity of the dryer, and switch on the dryer's blower and cooler/heater. Take care of the drying time of the product; excessive drying leads to colour change, crack formation, and breakage of the grains. Handle the tray carefully during loading and unloading. Avoid spillage of FRK in the dryer while loading the tray.

B-6.2 Potential Hazards and Remedies

Potential Hazards	GMP/CCP	Remedies
Improper drying	GMP	Check the predetermined drying conditions and monitor the drying temperature and air velocity as per SOP.

Potential Hazards	GMP/CCP	Remedies
Incorrect moisture content	CCP	Check the drying conditions and dry the FRK till the desired moisture in FRK is achieved.
Cracks in the FRK	CCP	Stir the FRK intermittently and lower the air velocity.

B-7 POLISHING OF FORTIFIED RICE KERNELS**B-7.1 Procedure**

Check overall cleanliness of hopper, polishing roll, the screen of rice polisher, and receiving tub. Check the initial moisture content of dry FRK, it shall be less than or equal to 12 percent. Check the adjustment of the screen and polishing roll of the polisher. Check the adjustment of the feeding gate of the hopper to maintain a uniform feeding rate of FRK in the polisher. Start the polisher and start the loading of dry FRK in the hopper of the polisher. Open the feeding gate slowly to pass the FRK in the polishing chamber. Polish FRK for 15-20 s for smoothening the surface of the FRK and store it in storage tanks or send it for packaging. Collect the fine dust and keep it aside.

B-7.2 Specification of Polished FRK

FRK shall have smooth and finish surface and conform to the specifications given in 4.

B-7.3 Potential Hazards and Remedies

Potential Hazards	GMP/CCP	Remedies
Foreign bodies (emery particles)	GMP	Check the emery roll properly.
Metal parts	CCP	Routine check of screen and fittings.

B-8 PACKAGING OF FORTIFIED RICE KERNELS**B-8.1 Procedure****B-8.1.1 Form Fill and Seal (FFS) Packaging**

Check overall cleanliness of hopper, rolls, packaging film, feeding cups, heater, conveyor belt, etc. Check the temperature of the horizontal and vertical sealer.

Sealing temperature depends on the packaging film. Mount the packaging roll carefully. Adjust the packaging film at the vertical sealing heater and horizontal sealing heater. Check the required air pressure. Switch on the packaging machine and set the temperature of horizontal and vertical sealing heaters. Load the FRK in the hopper and cover it with a lid to avoid cross-contamination. Start the packaging operation and collect the packaged FRK (approximately 1-5 kg) and pack them in the boxes.

B-8.1.2 Manual Packaging

For bag packaging, the FRK shall be stored in the storage tank and packed in suitable packaging bags as stated in 5. The bag shall be properly stitched (preferable double stitching) and sustain the harsh handling.

B-8.2 Potential Hazards and Remedies

Potential Hazards	GMP/ CCP	Remedies
Incorrect weight	GMP	Check weighing balance and predetermined flow rate.
Metal foreign bodies	CCP	Pass the pouches through metal detectors.
Package sealing/ stitching	GMP	Check the package/bag.

B-9 RECORD KEEPING AND MAINTAINENCE

All the records pertaining to receipt of raw material, acceptance and rejection of raw material, processing parameters, preventative maintainence and schedule shall be maintained.

ANNEX C

(Clause 4.5.2)

DETERMINATION OF COOKING TIME OF FORTIFIED RICE KERNELS

C-1 APPARATUS

C-1.1 Cooking Tubes

C-1.2 Burner

C-1.3 Stop Clock

C-2 PROCEDURE

Take 15 g milled rice and into a glass cooking tube with 15 ml of boiling water and immediately place the tube

in the boiling water. Note the time when 90 percent of the total grains no longer show an opaque center. Add two minutes to the noted time to calculate the cooking time.

Repeat the procedure using fortified rice kernels in place of milled rice. Cooking time shall be within 10 percent deviation to milled rice to which it is to be blended.

ANNEX D

(Foreword)

COMMITTEE COMPOSITION

Foodgrains, Allied Products and Other Agricultural Produce Sectional Committee, FAD 16

<i>Organization</i>	<i>Representative(s)</i>
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