ALL ABOUT
WHEAT FLOUR FORTIFICATION
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3. Good Manufacturing & Hygiene Practices  11
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TECHNICAL MANUAL
A. FLOW DIAGRAM FOR WHEAT FLOUR MILLING

1. Wheat grains
2. Sampling
3. Incoming Inspection
4. Not approved → Reject
5. Silos
6. Cleaning and Washing

CHAKKI FLOUR MILLING
- Wheat Flour
- Fortification
- Sampling for Vitamins & Minerals Testing
- Packaging
- Warehousing, Dispatch and Transportation

ROLLER FLOUR MILLING
- Conditioning and Dehulling
- Grinding
- Sifting
- Sooji (Semolina)
- Maida (All purpose flour)
- Wheat Flour
- Fortification
- Sampling for Vitamins & Minerals Testing
- Silos
- Packaging
- Warehousing, Dispatch and Transportation
B. PROCUREMENT NORMS
The wheat grains are received in gunny bags or in bulk in vehicles. Incoming vehicles must be inspected to ensure that wheat grains are transported in clean vehicles.

• TESTING
The incoming grains are tested for moisture content, foreign matter, infestation, broken grains and damage.

C. STORAGE NORMS
Wheat grains are stored in gunny bags and/or large silos made of non-toxic material like stainless steel or aluminium.

D. PROCESS NORMS

The processing of wheat grains is done in the following stages-

1. **Cleaning and Washing**: The wheat grains are cleaned before further processing. The stones, sticks, metal particles, husk and other extraneous matter are removed by sieving, magnets, aspirators, de-stoners. The grains are further washed and dried to remove the dirt from the grain surfaces.

2. **Conditioning and De-hulling**: Conditioning is the treatment of wheat grains with water and heat to change the structure and biochemical properties of the grains. It makes the wheat grains soft hence making the milling and dehulling process more efficient and quick. Moisture is increased up to 16-18% during the process.

3. **Grinding and Sifting**: After cleaning and removal of husk, the wheat grains are passed through rollers and grinders to obtain wheat flour and other products like Sooji (Semolina) and Rawa etc. These different grades of flour are separated using sifters based on their particle size and collected separately.

4. **Fortification**: Wheat flour fortification is generally done by continuous mixing method where the vitamins and minerals premix is added in a controlled manner through a volumetric feeder to the wheat flour after grinding before it reaches the prepack tank. Wheat Flour is fortified with iron, folic acid and vitamin B12.
E. PROCESS OF WHEAT FLOUR FORTIFICATION

The technology for fortifying wheat flour is simple.

1. Micronutrients in the form of a premix are added through a volumetric feeder located towards the end of the milling process.

2. The screw rotates inside a chamber containing the premix and pushes the premix through an outlet spout. The amount of premix added to the flour can be modified by changing the motor speed.

3. The premix can be either fed directly into the flour by gravity or by air convection using a pneumatic system.

4. In a gravity driven system, best site for adding micronutrients is before the midpoint along the screw conveyor that collects flour from all the mill passages, just before bulk storage or sacking. If the feeder is placed towards the beginning of the screw conveyor, the amount of flour in the conveyer will be too little. If, on the other hand, the feeder is located toward the end of the screw conveyer, the required homogenisation will not be achieved. In a pneumatic system, feeders can be placed in a remote centralised location.

F. COST OF FORTIFICATION

The incremental cost of fortification comes out to be less than 10 paise per kg of wheat flour and includes cost of premix. There might be a onetime cost of equipment (Micro-Doser).

G. HANDLING AND STORAGE OF PREMIX USED FOR FORTIFYING WHEAT FLOUR

- Micronutrient premixes must be stored in a dry, cool and clean place away from direct sunlight.
- Premix should be stored at a temperature not more than 25°C.
- Follow “First-in, First-out” (FIFO) system.
- Avoid direct touch, inhaling, and direct consumption of premix.
- Fortified Wheat Flour must be stored under dry, ventilated and hygienic conditions.
Simplified Flow Chart for Flour Milling

Volumetric Feeder for Adding Micronutrient Premix
H. QUALITY ASSURANCE

- Micronutrient estimation in flour can be done by simple classical methods (e.g. fluorometric for B1 and B2 and spectrophotometric for iron) or by faster methods that require more sophisticated equipment (e.g. HPLC for folic acid and atomic absorption for iron).
- Fortified Wheat Flour shall be free from objectionable matter; not contain any substances originating from micro-organisms or any other poisonous or deleterious substances such as anti-nutritional factors, heavy metals or pesticide residues, in amounts which may represent a hazard to health.
- Calibrate the feeder on a regular basis and whenever the premix composition is changed or the suppliers changed.
- Calculate the feed rate for the feeder to establish an acceptable dosage target addition rate for premix.
- Check the weighing process of the feeder regularly.
- Perform spot test at a specified frequency.
- Send samples for full analytical testing of all the nutrients added to flour at a specified frequency.
- Use an inventory control system to verify that the amount of premix being used is close to the specified or target rate.
- All batches of premix should come with a Certificate of Analysis (CoA) covering chemical & microbiological testing.

I. MICRO FEEDER SPECIFICATIONS

- Premix feeder, a separate unit comprising 0.5 /1 HP ac gear motor, gear box, hopper and regulator
- Variable control drive (VFD) with panel.
- Power requirement-220-240 v.
- Premix feed rate-5 g to 50 g/minute adjustable. Can be increases if required.
- Accuracy-1-2% free flowing.
- Ambient operating temperature-0 to 50-degree c.
- Feeder hopper capacity-approx.14 kg premix
- Flow properties-similar to wheat flour or starch.
- Construction –suitable for food use in flour mill environment i.e. stainless steel 304.
- Electromagnetic vibrator for free flow of material.
- Low level sensor.

J. PACKAGING NORMS

- Packaging process involves setting up primary packaging material, filling of wheat flour into packages and sealing to make the finished product ready for sale.
- Only food grade primary packaging material should be used.
- Batch no. and date of manufacturing should be correctly printed on the finished product package.
FREQUENTLY ASKED QUESTIONS
Q: Why fortify wheat flour?
A. Wheat flour is one of the most commonly consumed staple food in India with an average per capita per day consumption of wheat flour ranging between 150-300 grams in India. Wheat flour is thus a suitable food vehicle for fortifying with Iron, Folic Acid and Vitamin B12.

Moreover, during milling of wheat grain into wheat flour, a large proportion of folic acid, iron, vitamin B-6, thiamine, riboflavin, niacin present in whole-wheat kernels are lost. This decreases the nutritive value of the flour. Thus, nutrients may be added to flour in amounts equal to those present before processing to make fortified flour.

There is adequate evidence that fortification of wheat flour is effective, simple and an inexpensive strategy for providing important vitamins and minerals to large segments of the population without requiring change in food habits or dietary pattern or measures to address the problem of compliance.

Q: How fast can health effects of consuming fortified wheat flour be expected?
A. Regular intake of fortified wheat flour can show positive impact on the iron status within 6-12 months of starting the consumption.

Q: What is a Premix?
A. A premix is a powdered blend of vitamins and minerals that flour millers use for fortification. Premixes are usually prepared with diluents so they can be added to flour at a standard dosage rate such as 200, 250, or 300 grams per metric ton. A premix allows a miller to add several micronutrients at the same time to flour. It has a vegetarian source of origin. As per the direction under section 16(5) of Food Safety and Standards Act, 2006, heme iron shall not be permitted as a source of iron for the purpose of food fortification.

Q: What nutrients are added to flour for fortification?
A. The most common nutrients added to flour are iron, folic acid and vitamin B12. Other vitamins and minerals that can be added to flour are thiamine, riboflavin, niacin, zinc, pyridoxine and vitamin A.

Q: Are there any national regulations and specifications for wheat flour fortification?
A. Yes, there are Food Safety and Standards (Fortification of Foods) Regulations, 2018 which includes the standards for fortification of staple foods including wheat flour which says Atta, when fortified, shall contain added iron, folic acid and Vitamin B-12 at the level given in the table below:

<table>
<thead>
<tr>
<th>Micronutrient</th>
<th>Level of Nutrients (per kg)</th>
<th>Source of Nutrients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>28 mg-42.5 mg*</td>
<td>Ferrous citrate or Ferrous lactate or Ferrous sulphate or Ferric pyrophosphate or electrolytic iron or Ferrous fumarate or Ferrous BisGlycinate;</td>
</tr>
<tr>
<td>Micronutrient</td>
<td>Level of Nutrients (per kg)</td>
<td>Source of Nutrients</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>500-750 ug RE</td>
<td>Retinyl acetate or Retinyl Palmitate;</td>
</tr>
<tr>
<td>Thiamine (B1)</td>
<td>1-1.5 mg</td>
<td>Thiamine hydrochloride or Thiamine mononitrate;</td>
</tr>
<tr>
<td>Riboflavin (B2)</td>
<td>1.25-1.75 mg</td>
<td>Riboflavin or Riboflavin 5’phosphate sodium ;</td>
</tr>
<tr>
<td>Niacin (B3)</td>
<td>12.5-20 mg</td>
<td>Nicotinamide or Nicotinic acid;</td>
</tr>
<tr>
<td>Pyridoxine (B6)</td>
<td>1.5-2.5 mg</td>
<td>Pyridoxine hydrochloride;</td>
</tr>
<tr>
<td>Zinc</td>
<td>10-15 mg</td>
<td>Zinc Sulphate;</td>
</tr>
</tbody>
</table>

**Q:** Does fortification affect the colour, smell and taste of foods made with fortified flour?

A. Fortification does not impact the organoleptic and sensory attributes of flour such as colour, taste, smell when used for making chapati (flat bread), baked products, breads and noodles. Also, the micronutrients added to the flour as a part of fortification are heat stable and not lost during cooking.

**Q:** Does fortification affects the shelf life of atta and maida?

A. Fortification has no impact on the shelf life of the product.

**Q:** How will you identify fortified wheat flour in the market?

A. Fortified flour package will have a [logo indicating fortification] logo indicating that it is fortified and the nutrition label on the packed flour product would indicate the various added micronutrients and their quantities, as specified by FSSAI. Non-fortified flour products cannot use the [logo] logo.

**Q:** How is flour fortified at the mill?

A. The fortification process is usually a continuous process that adds premix to the flour as it is being produced. In some cases, fortification takes place in a high-speed blending system following the flour milling process. In this case, this system is usually installed as part of a new flour-mill.

**Q:** What is the function of the feeder in fortification of wheat flour?

A. Stainless steel feeders accurately add premix directly to the flour. The feeder is equipped...
with a variable speed drive motor which has a discharge mechanism and a hopper agitation device attached with a gearbox. The agitation device provides an even, consistent flow of premix into the flour.

Q: What different types of feeders available?
A. Feeders have one of three discharge systems: Screw discharge, disk discharge and drum discharge. Most modern feeders use the screw discharge system. The size of the discharge screw and the speed range of the variable speed motor allow for a wide range of discharge rates. The feeders can be connected electronically or electrically to the main control panel or microprocessor that controls the flour mill. In addition, the feeder can be equipped with load cells which convert the feeder from a volumetric feeder into a gravimetric or loss-in-weight feeder.

Q: Where is the feeder installed?
A. The feeder is usually on top of the final flour collection conveyer where premix drops by gravity into flour as it moves through the conveyer. When an existing mill has to install a feeder to begin fortification, there may not be room on top of the conveyer for a feeder. In this case the feeder can be installed on the same floor as the conveyer. The feeder is connected to the conveyer using a blow-line which blows the premix from the feeder into flour.

Q: How do you ensure that feeder is operational?
A. The feeder must consistently deliver premix to the flour conveyer at a point that allows for sufficient mixing time so that the premix is evenly dispersed in the flour. Tips for doing that are:
   • Place the feeder more than three meters from the discharge end of the conveyer where the premix is added.
   • Interlock the feeder with the mill control panel or the first break sifter or the conveyer motor so that if the mill stops, the feeder stops.
   • Equip the feeder with a low-level alarm indicator so that the feeder does not run out of premix.

Q: What does fortification cost the milling industry?
A. To fortify flour, the miller may make a one-time fixed expense of buying feeders. Apart from that, there will be variable costs owing to the purchase of premix and supplies for quality control and quality assurance testing. The one-time capital cost of purchasing necessary equipment and setting up a laboratory for qualitative tests for internal quality assurance is estimated between 80,000 INR to 150,000 INR.

Q: Is fortified wheat flour safe for children, pregnant and lactating women?
A. Children, pregnant and lactating women especially benefit from consuming fortified wheat flour as they require high levels of vitamins and minerals to support physical growth and the development of new tissues.

Q: Are there any known side effects to consume fortified wheat flour?
A. No side effects on health have been reported in the studies published on fortified wheat flour.
GOOD MANUFACTURING AND HYGIENE PRACTICES
1. LOCATION AND SURROUNDINGS
   • The flour mill should not be located in areas with high risk of floods.
   • You should always check that the plant premises is free from stagnant water, scattered garbage and scrap to maintain the plant surroundings pest free and hygienic.
   • You should have residential areas away from the manufacturing area.
   • You must report any pest sighting in the surrounding areas like insects, rats, snakes, animals, birds etc. immediately to the factory manager and take all possible preventive steps for pest control.

2. INFRASTRUCTURE AND LAYOUT
   • Walls and floors of the raw material storage area, production and packaging section and the warehouse should be well maintained without any cracks or holes to prevent rodents like rats, cockroaches etc. from hiding and to prevent dirt from accumulating.
   • Leave free space in between and around the machines especially in the packaging section to allow easy movement and cleaning.
   • It is preferable that the walls and floor should be of light color so that any pests or dirt can be easily seen and cleaned.
   • Cover the lights on the walls and ceilings with shatter-proof plastic/fiber covering to prevent broken glass pieces from falling into the processing area.
   • Get all the windows screened with wire mesh and the drain holes covered with metal grills to prevent pests from entering the processing area. Clean the dirt and food dust from these wire mesh and grills every day.
   • Place air curtains or strip curtains on the doors/entrances to prevent entry of pests and dust/dirt from outside.
   • Warehouses should have proper ventilation and illumination. See that there are adequate lights and windows/exhausts for the same.

3. EQUIPMENT MAINTENANCE
   • You should periodically check that the equipment and containers are not damaged (corroded, rusted, broken) to avoid metal particles chipping off and entering the product stream.
• Place the equipment in the processing areas with sufficient free space such that they are easy to clean and maintain.

• Label the equipment and mark the pipelines (color coding) for easy identification.

• You should label the vessels/ containers used for storage of wastes and by-products (Sooji, Maida etc.) for easy identification.

• Always cover all vessels and containers containing flour with a proper fitting cover/lid to protect the wheat flour completely from dust, dirt and flies and other insects as well as air.

• Check the machines/equipment regularly. For e.g.
  ➢ all steam supply valves and steam traps for leakage
  ➢ weighing equipment for errors
  ➢ grinding stones for chipping
  ➢ equipment calibration

• You must lubricate the machines periodically with food grade lubricants.

4. DRAINAGE AND WASTE DISPOSAL

• You must cover all the openings of the drains with metal grills to avoid garbage from entering the drains leading to blockage and also to prevent entry of insects and rodents.

• Place waste collection bins in all the manufacturing sections of the plant for efficient collection of waste. Number of bins should be based on the average amount of waste generated in that particular area.

• You must dispose off the waste/scrap periodically to avoid accumulation and breeding of pests.

• The waste generated shall not be disposed into the open areas outside the factory, on roads or into the drains to avoid environmental contamination. You must ensure that the waste disposal is carried in eco-friendly manner at designated sites.

• Different kind of wastes like paper, food waste, plastic waste and hazardous waste can be collected separately for easy disposal.
PACKAGING & LABELLING REQUIREMENTS
WHEAT FLOUR

1. **NUTRIPANEL:**

<table>
<thead>
<tr>
<th>Nutritional Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(Approximate Composition per 100 g)</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>Kcal</td>
</tr>
<tr>
<td>Fat</td>
<td>g</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>g</td>
</tr>
<tr>
<td>Of which Sugars</td>
<td>g</td>
</tr>
<tr>
<td>Proteins</td>
<td>g</td>
</tr>
<tr>
<td>Dietary Fibre</td>
<td>mg</td>
</tr>
<tr>
<td>Added Iron</td>
<td>X mg *</td>
</tr>
<tr>
<td>Added Folic Acid</td>
<td>Y mcg or µg **</td>
</tr>
<tr>
<td>Added Vitamin B12</td>
<td>Z mcg or µg **</td>
</tr>
</tbody>
</table>

*mg stands for milligrams
** mcg/µg stands for micrograms

2. **+F LOGO**

+F logo should be in blue colour as per the logo dimensions and colour codes mentioned in Appendix 1

Fortified with Iron, Folic acid and Vitamin B12

Fortified with “Name of Fortificant (s)” should be in Black Colour

3. **Ingredients:** Wheat Flour/Whole Wheat Flour, Iron (Source of Iron), Folic Acid and Vitamin B12

In addition to usual ingredients, add Iron (Source of Iron), Folic Acid and Vitamin B12 in the ingredient list

4. **Declaration on the pack:** “People with Thalassemia may take under medical supervision”.

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Mention **Added Iron**, **Added Folic Acid** and **Added Vitamin B12** in addition to other nutrients mentioned in the Nutritional Information.

X is the level of added iron (in mg), Y is the level of added Folic acid (in mcg) and Z is the level of added Vitamin B12 (in mcg) which must be as per FSSAI standards for food fortification. X, Y and Z will be absolute values falling within the prescribed ranges.
**+F LOGO DIMENSIONS**
Below is an indicative size of the logo. It can be used in any size keeping the ratio intact.

![Logo Dimensions Image]

All dimensions in millimeters

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>a</th>
<th>E (wxh)</th>
<th>F (wxh)</th>
<th>G (wxh)</th>
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<td>20</td>
<td>2.2</td>
<td>3.1</td>
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<td>7.27 x 9.51</td>
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<td>40</td>
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<td>6.3</td>
<td>1.7</td>
<td>14.54 x 19.03</td>
<td>11.35 x 11.68</td>
<td>33.96 x 21.87</td>
</tr>
<tr>
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<td>80</td>
<td>8.9</td>
<td>12.5</td>
<td>3.4</td>
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<td>22.7 x 23.36</td>
<td>67.92 x 43.75</td>
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<tr>
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<td>160</td>
<td>17.9</td>
<td>25.4</td>
<td>6.9</td>
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<td>45.39 x 46.72</td>
<td>135.85 x 87.5</td>
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<tr>
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<td>320</td>
<td>35.6</td>
<td>50.6</td>
<td>13.8</td>
<td>116.35 x 152.29</td>
<td>90.77 x 93.44</td>
<td>275.25 x 175.01</td>
</tr>
</tbody>
</table>

**COLOR CODES**
PANTONE 3005 C
C-100, M-46, Y-2, K-0
R-0, G 116, B-200
Web- 0074C8

**COLOR CODES**
PANTONE BLACK
C-0, M-0, Y-0, K-100
R-35, G-31, B-32
Web- #231F20
For more information, please contact

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