ALL ABOUT
OIL FORTIFICATION

FORTIFIED
SAMPOORNA POSHAN
SWASTH JEEVAN
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A. FLOW DIAGRAM FOR EDIBLE OIL PROCESSING

Oil seeds

Incoming inspection (QA check)

- Approved
  - Storage
  - Cleaning
  - Conditioning
  - Dehulling

Conditioning and Pretreatment

Oil Expelling

- De-oiled cakes
  - Mechanical pressing
  - Solvent extraction

Crude oil

- Filtration
- Degumming/Dewaxing

Bleaching earth + Activated Carbon

- Neutralization
- Bleaching
- Deodorization

Spent Earth

Antioxidant addition

- Quality testing
- Fortification

Sampling for vitamins

- Fortified
- Approved

Packaging

- Approved

Primary packaging material

Warehousing, Dispatch, Transportation

Bulk transportation

Oil tanks
B. PROCUREMENT NORMS
While receiving the oil seeds in gunny bags or in bulk, take a random sample from each batch/vehicle of oil seeds and send it for quality check by the QA/QC department.

- TESTING
  The incoming grains are tested for moisture, foreign matter, infestation and damaged seeds.

C. STORAGE NORMS
- Store the oil seeds in clean gunny bags or large silos made of stainless steel/aluminum.
- Store the oil seeds at ambient temperature.
- Ensure adequate ventilation in the oil seeds storage area.
- FIFO (First in, first out) system of stock rotation must be followed.

D. PROCESS NORMS
1. Cleaning and Pre-treatment: Clean the oil seeds by passing through sieves, sifters, de-stoners to remove all the dirt, stones, weeds and other extraneous matter and then leave them for conditioning/cooking before the seeds are flaked and used for oil extraction.
2. Oil Extraction: Two major methods used in the edible oil industry for extraction of oil from the oil seeds are:
   a) Mechanical Pressing
   b) Solvent Extraction
3. Refining: Refining is the process of removing undesirable compounds including foreign matter, gums, free fatty acids, wax, color pigments and odoriferous compounds from the crude oil to obtain oil of edible quality.
4. Fortification of Edible Oil: Fortification is the process of adding vitamin premixes with edible oil in a controlled manner. It is a two-step process:
   a) Preparing the pre-blend
   b) Mixing the pre-blend with refined oil

E. PREPARATION OF PRE-BLEND FOR 5 MT OF REFINED OIL:

1. Take one bottle of pre-mix (100g)
2. Heat pre-mix to 45°C in water bath for 15 minutes
3. Gradually pour this pre-mix into 5L refined oil in a stainless steel container
4. Stir continuously for 10-15 minutes with a clean stainless steel rod
5. Rinse the pre-mix bottle at least three times with the oil
6. Pour the pre-blend into the blending tank for circulation and mixing.

The mixing of pre-blend with refined oil can be done either by batch mixing process or by continuous mixing method.
• Procure vitamin premixes only from FSSAI notified approved premix suppliers.
• Store the pre-mix in a dark, dry, cool place away from sunlight.
• Do not use the pre-mix directly. Always prepare a pre-blend of the pre-mix before mixing it in the oil tank.
• Heat the premix in a water bath at 45°C for 15 minutes before making the preblend.
• Maintain a constant flow rate of pre-mix blend into the oil to ensure homogenized mixing.
• In continuous mixing process, place the micro dozer 5-10 meters before the refined oil tank to ensure efficient mixing.
• In batch mixing process, fix the blender close to the bottom of the blending tank to minimize the mixing of air into the oil.
• Test the fortified oil periodically (every batch) by the blue ring test which is a qualitative test that confirms that vitamin A is present in the oil.

F. TECHNICAL SPECIFICATIONS FOR THE CHURNAS AND THE OIL FORTIFICATION PROCESS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>SPECIFICATION</th>
<th>5 TON CHURN</th>
<th>10 TON CHURN</th>
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<tbody>
<tr>
<td>1.</td>
<td>Thickness of Plate of Cylinder</td>
<td>5 mm</td>
<td>8 mm</td>
</tr>
<tr>
<td>2.</td>
<td>Diameter of the Cylinder</td>
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<tr>
<td>3.</td>
<td>Height of the Churn Shell (H-2D)</td>
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<td>4.0 Meter</td>
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<td>4.</td>
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<td>14.2 KL</td>
</tr>
<tr>
<td>5.</td>
<td>Cone Height and Volume Extra</td>
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<td>Yes</td>
</tr>
<tr>
<td>6.</td>
<td>Agitator, - 1/2 D</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>7.</td>
<td>Agitator System</td>
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<td>8.</td>
<td>Vitamin Adding Funnel</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>9.</td>
<td>Covering of Churn, 1/3 Flip Top</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>10.</td>
<td>Oil Inlet, Near Bottom with Vaccum Bracking System</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>11.</td>
<td>LUG Support without Column</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>12.</td>
<td>Working plateform of chequered Plate, 0.75 Meter working around the diameter with support on Churn with Railing and stairs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

G. PACKAGING NORMS

Packaging process involves setting up primary packaging material, filling of fortified edible oil, sealing and packing in primary and then secondary containers.

H. WAREHOUSING, DISPATCH AND TRANSPORTATION

An adequate system of warehousing, dispatch and transportation needs to be put in place to ensure that the edible oil packages reach the consumer safely.
FREQUENTLY ASKED QUESTIONS
Q: What is edible oil fortification?
A: When vitamins are added externally to edible oil to enhance its nutritional value, it is called edible oil fortification. Any type of oil like Soybean Oil, Palmolein Oil, Groundnut Oil, Cotton Seed Oil, Mustard Oil etc. can be fortified.

Q: Why fortify edible oils and fats?
A: Recent National Nutrition Monitoring Bureau (NNMB) survey and a Report of the expert group of Indian Council of Medical Research (ICMR) in 2012 has stated that India has very high burden of Vitamin A and D deficiencies, amongst both young children and adults particularly in urban areas since they are physically less active and have a very limited exposure to sunlight.

Since oil is consumed by all population groups, fortification of oil with certain micronutrients is a good strategy to address micronutrient malnutrition.

Q: What are the advantages of oil fortification?
A: • A safe and effective means of improving public health.
• Excellent vehicle for adding nutrients to the diet as consumption of oil is among all the population groups and is reasonably high.
• Cost effective method to address the nutritional deficiencies.

Q: What is the feasibility of edible oil fortification in India?
A: Oil fortification technology is simple. Equipment is readily available and the concept, technology and quality control procedures are well established for sustained production within India. Hence, appropriately and adequately fortified oil can be made available through the regular open market commercial channels or through the public funded programmes like the Integrated Child Development Scheme (ICDS), Mid-Day Meal (MDM) and Public Distribution System (PDS).

Q: What are the micronutrients and which micronutrients can be used as fortificants to fortify edible oil?
A: Micronutrients are the nutrients which are required in miniscule amount by body but have important role to play in the body functions. Vitamins and minerals are classified as micronutrients. Micronutrients help in formation of hormones and enzymes.

Various micronutrients like Vitamin A and D are fat soluble, have better stability in edible oil than other food vehicles and can be uniformly distributed in oil, are used as fortificants to fortify edible oil.
Q: Is the micronutrient or premix used from a vegetarian source?
A. Yes, premix is manufactured from vegetarian sources. Vitamin A in the form of Retinyl Acetate/Retinyl Palmitate and Vitamin D in the form of Cholecalciferol/Ergocalciferol (only from plant source) can be used.

Q: How safe is fortified edible oil for consumers?
A. Govt. of India mandated fortification of “Vanaspiti” or the Hydrogenated oil fats and margarine, with vitamin A in 1953. Madhya Pradesh, Gujarat and Rajasthan have been fortifying edible oil since 2006. The amount of vitamins added to oil is usually set at a proportion of the individual's daily requirement and is usually less than one third of the total Recommended Dietary Allowances (RDA). By applying strict monitoring and supervision measures, companies can ensure that there is no excessive intake of any vitamin.

Experiences in countries that are already fortifying edible oil (United States since 1930, Bangladesh, Nigeria, Morocco, Yemen, Pakistan, Tanzania, Indonesia, Uganda) show that fortified edible oil is completely safe for consumers and the benefits are enormous.

Q: How does fortification affect the shelf life of edible oil?
A. Fortification has no impact on the shelf-life of any kind of edible oil. The vitamins have a shelf life of their own and they do become less active over time.

Q: Does fortification change appearance, taste, texture and flavor of the edible oil?
A. No. When deciding on the appropriate premix for edible oil fortification, only those vitamins are considered, which will not change the appearance, taste, texture and flavour of the oil/food. The concept is based on the fact that the consumer buying behavior should not be affected by the fortification process.

Q: Is edible oil fortification costly?
A. Fortification of oil is relatively inexpensive and affordable. The cost of fortificant per se is just about 8-10 paise per kg., depending upon the type and number of micronutrients added.

Q: Are there any national regulations and specifications for edible oil fortification?
A. Yes, there are Food Safety and Standards (Fortification of Foods) Regulations, 2018 which includes the standards for fortification of staple foods including edible oil which says vegetable oil, if fortified, shall be fortified with the following micronutrients, at the level given in the table below:
<table>
<thead>
<tr>
<th>S. No</th>
<th>Nutrient</th>
<th>Level of nutrient</th>
<th>Source of nutrient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vitamin A</td>
<td>6 µg RE- 9.9 µg RE per gm of oil</td>
<td>Retinyl acetate or Retinyl palmitate</td>
</tr>
<tr>
<td>2</td>
<td>Vitamin D</td>
<td>0.11 µg -0.16 µg per gm of oil</td>
<td>*Cholecalciferol or <em>Ergocalciferol (</em> Only from Plant Source)</td>
</tr>
</tbody>
</table>

Note: Vitamin A (retinol): 1 IU= 0.3 µg RE (Retinol Equivalent); Vitamin D (Cholecalciferol or Ergocalciferol): 1 IU= 0.025 µg

**Q:** What is the process for storing premix used for fortification of edible oil?
A. Premix should be stored at 20-25 degree centigrade temperature, in a cool, dry place, preferably in an air conditioned room.

**Q:** Can the premix used for edible oil fortification be consumed directly?
A. No, never. Premix has micronutrients in the range of grams or million international units, which is toxic for the body if consumed directly.

**Q:** Will there be any loss of micronutrients after heating the fortified edible oil?
A. As per various scientific evaluations, heating does not destroy vitamins completely, though frying can destroy vitamins (A, and D) to some extent. The loss of vitamin A, D and E depends on the number of times the same oil is used for frying. There is an estimated loss of just about 20-25% of the vitamins originally added as fortificants. After 4 repeated frying, about 60% of the original levels of added vitamin are lost. They have similar stability properties to heat and light.

**Q:** What claims is a company allowed to make to market their fortified edible oil?
A. Oil producing and packaging companies can state that their product (edible oil) is fortified with vitamins. But they need to indicate levels of added micronutrients in the nutritional information as required by the Packaging and Labelling Requirements mentioned in Food Safety and Standards (Fortification of Foods) Regulations, 2018.
GOOD MANUFACTURING AND HYGIENE PRACTICES
1. LOCATION AND SURROUNDINGS
   • The edible oil plant should not be located in areas with high risk of floods.
   • Plant premise should always be free from stagnant water, scattered garbage and scrap to maintain the plant surroundings pest free and hygienic.
   • Residential areas should be away from the manufacturing area.
   • Any pest sighting in the surrounding areas like insects, rats, snakes, animals, birds etc. must be reported immediately to the factory manager and all the possible preventive steps should be taken 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.
   • Free space should be left in between and around the machines especially in the packaging section to allow easy movement and cleaning.
   • The walls and floor should be of light color so that any pests or dirt can be easily seen and cleaned.
   • The lights on the walls and ceilings should be covered with shatter-proof plastic/fiber covering to prevent broken glass pieces from falling into the processing area.
   • All the windows should be screened with wire mesh and the drain holes be covered with metal grills to prevent pests from entering the processing area. All the dirt and food dust should be cleaned from these wire mesh and grills every day.
   • The air curtains or strip curtains to be placed 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.
   • The equipment and containers should be checked on periodic basis for any damage (corrosion, rust, breakage) to avoid metal particles chipping off and entering the product stream.
   • The equipment in the processing areas should be placed with sufficient free space so that they are easy to clean and maintain.
   • The equipment to be labelled and the pipelines to be color coded for easy identification.
   • The vessels/containers used for storage of wastes and by products(sooji/maida) should be labelled for easy identification.
• All the vessels and containers containing oil should be covered with a proper fitting cover/lid to protect the oil completely from dust, dirt and flies and other insects as well as air.

• The machines should be checked regularly for:
  ➢ all steam supply valves and steam traps for leakage
  ➢ weighing equipment and temperature gauges for errors
  ➢ all oil pumps and pipelines for leakage
  ➢ equipment calibration

3. DRAINAGE AND WASTE DISPOSAL

• All the openings of the drains must be covered with metal grills to avoid garbage from entering the drains leading to blockage and also to prevent entry of insects and rodents.

• It should be ensured that the waste generated like stones, extraneous matter, spilled oil etc. is stored away from the raw material storage or food processing areas and in covered containers.

• The waste/scrap must be disposed off 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. It must be ensured that the waste disposal is carried out in eco-friendly manner at designated sites.

• The waste collection bins should be placed 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.

• Different kind of wastes like paper, food waste, plastic waste and hazardous waste can be collected separately for easy disposal.

4. CLEANING AND MAINTENANCE

Regular cleaning and maintenance of the infrastructure and the equipment is necessary to maintain good hygiene in the premises and you must take all the necessary actions to keep the premises clean.

• Develop a daily house-keeping & sanitation schedule that specifies
  ➢ the instructions for cleaning,
  ➢ time scheduled for cleaning, and
  ➢ person responsible for cleaning

• Housekeeping chemicals should be stored at dedicated places to avoid mix-up and/or mis-use by workers.
• Cleaning chemicals should be handled with care and used as per the instructions given on the label.
• All the used equipment must be cleaned at the end of day’s operations.
• The ceilings, walls, floors, doors, windows, the wire mesh and grills should be cleaned periodically to remove any accumulated dust, dirt, spider webs etc.
• A record of all the cleaning activities in the factory must be maintained.

SAMPLE CLEANING RECORD

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Cleaning Method/ Chemicals Used</th>
<th>Employee Initials</th>
<th>Verified By</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

5. PEST CONTROL SYSTEM

Pests like rats, cockroaches, worms, lizards and their droppings, feathers or wings of birds etc. are a common source of contamination in the plant and should be prevented from entering the premises to ensure food safety.

• A check for any rats, cockroaches, spiders, lizards or stray dogs must be kept if seen in the premises.
• The spider webs on the ceilings, walls, doors, grills etc. should be cleaned regularly.
• Any stray animals like dogs or cats should not be allowed to enter the premises for which doors of the area should be closed.
• Strip curtains or air curtains can be used to limit the entry of insects into the working area.
• The windows and exhaust/ ventilation openings should be screened with wire mesh to control the entry of birds from outside.
• Glue pads, traps, insectocuters and insecticides/ pesticides might be used to get rid of the pests but before spraying chemicals, food items as well as equipment used for oil manufacture should always be covered.
• As mentioned in the general section for pest control management, 4D system should be used.
6. PERSONNEL HYGIENE

Hygiene of the workers is important for food safety as the workers are in direct contact with the food. It includes the cleanliness of clothes, shoes, hands, toilets used by the workers, as well as the health of food handlers. Precautions must be taken to maintain the personal hygiene.

6.1 PERSONNEL FACILITIES

- It should be ensured that there is/are:
  - Adequate number of toilets for male and female workers. These toilets should be easily accessible by the workers but not too close to the processing areas.
  - Safe potable water, soap for hand washing and hand drying facility like hand dryers or disposable paper towels.
  - A facility for drying hands near the hand washing station.
  - A separate changing room for male and female workers to change into clean uniforms before entering the food handling area.
  - A separate area/canteen for resting and eating for the workers.

- The workers should be provided with uniform, disposable gloves, face masks, hair/beard nets, and clean foot wear/shoe covers to avoid contamination of oil during processing and packaging.

6.2 PERSONNEL CLEANLINESS

- The workers should be motivated to wash hands with soap and water every time after using toilet as well as after touching foreign objects like phones, money, etc. or scratching of body parts, coughing and sneezing. They should also be provided with hand sanitizers especially in the packaging area.

- The workers must be asked to trim their nails and not to wear any nail paints as it may contaminate the oil.

- The workers should not wear any jewellery or other accessories like bangles, watches etc. during handling of oil at any stage. In case of religious issues like wedding rings etc., hand-gloves must be used. Lost items must be reported.

- The workers should be encouraged to wear gloves, face masks and hair nets, uniforms at all times during the operation to avoid contamination and teach them how to dispose these masks, gloves, and hair nets. They should be asked to throw these after use in the designated bins and not in the open.

- Workers should not consume alcohol, tobacco or smoke cigarette within the processing area as it may contaminate the oil.

- Workers should not eat food within the premises and should use the designated canteen area or refreshment rooms for having their lunch and tea.

- Workers should not spit on the walls of the building.
6.3 HEALTH STATUS OF WORKERS

- Regular medical check-ups for food handlers should be conducted at least once in a year by a registered doctor to ensure they are not suffering from any infectious or communicable disease.
- Records of these health check-ups should be maintained.
- In case of epidemic in your area/city, in case of epidemic in the area/city, food handlers must get vaccinated.
- If suffering from any disease, the workers must inform the supervisor and should not be allowed inside the food handling premises.
- Workers with open cuts or wounds should not be allowed to handle food or equipment.
- First aid must be available for workers in case of emergency. A record for all first aid medicines and their consumption must be recorded and checked periodically.

7. TRAINING OF FOOD HANDLERS

Personnel, especially the food handlers, need to be trained on GMP and GHP so that they follow these practices while working in the manufacturing and storage areas.

- The workers should be provided with technical training about the use of machines, time and temperature requirements for oil manufacture at each stage, and also the hygiene practices that they must follow, once in every 6-8 months.
- The effectiveness of these training programs should be evaluated through periodic assessment of workers by through questionnaire, quiz, discussion and reviews.
PACKAGING & LABELLING REQUIREMENTS
EDIBLE OIL

1. NUTRIPANEL:

<table>
<thead>
<tr>
<th>Nutritional Information (Approximate Composition per 100 g)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>Kcal</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>g</td>
</tr>
<tr>
<td>Protein</td>
<td>g</td>
</tr>
<tr>
<td>Fat</td>
<td>g</td>
</tr>
<tr>
<td>Saturated Fatty Acids</td>
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<tr>
<td>Mono Unsaturated Fatty Acids</td>
<td>g</td>
</tr>
<tr>
<td>Poly Unsaturated Fatty Acids</td>
<td>g</td>
</tr>
<tr>
<td>Trans Fatty Acids</td>
<td>g</td>
</tr>
<tr>
<td>Added Vitamin A</td>
<td>X mcg/ ug* RE**</td>
</tr>
<tr>
<td>Added Vitamin D</td>
<td>Y mcg/ug*</td>
</tr>
</tbody>
</table>

* mcg/ug stands for micrograms
** RE stands for Retinol Equivalent

2. +F LOGO

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

Fortified with Vitamin A and Vitamin D

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

It may also carry a tag line “Sampoorna Poshan Swasth Jeevan” under the logo in black color (Optional Statement)

3. Ingredients: Name of the oil (For e.g. Sunflower oil/Soybean oil etc) Vitamin A, Vitamin D

In addition to usual ingredients, add Vitamin A and Vitamin D or D2 in the ingredient list
**+F LOGO DIMENSIONS**

Below is an indicative size of the logo. It can be used in any size keeping the ratio intact.

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>90.77 x 93.44</td>
<td>275.25 x 175.01</td>
</tr>
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</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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