PM Formalization of

Micro Food Processing Enterprises (PMFME) Scheme

HANDBOOK

OF

WALNUT PROCESSING

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CHAPTER 1

1.1 Introduction

Walnut (Juglans regia L.) is found all over the world. it is also be termed as one of the widely spread nuts globally. The scientific name Juglans regia. Where the common names are white, English, Persian walnuts, and common walnut. In early 1000 BC is was cultivated in Europe and western Himalayan regions to Balkans eastward areas. In the Current Scenario, walnut is cultivated commercially in southern Europe, Eastern Asia, and western South America. The global production of walnuts in the year 2019 was recorded as 4498442 tonnes as walnut with shell, providing a yield rate of 34462 hg/ha, and the area harvested has been calculated as 1305349 ha. (Food and Agriculture organization of the united nations(FAOSTAT), 2021,February 2) . Walnut has been a good source of nutrition since ancient times. Due to walnut high protein content and oil contents from the walnut kernels is comes as a great source of nutrition for human consumptions. Walnuts great nutrition profile as FAO is listed in the priority plants for nutrition and it has been classified as strategic species for human nutrition. The walnut has been consumed as the seed part of the fruit defined as walnut kernels in the form of raw, toasted walnut kernel grinned or mixed with other bakery goods or in the wet kitchen dishes for consumption. Walnut nutrition profile is rich due to its fats, proteins minerals, and vitamins content. Walnut is a great source of flavonoids, sterols, phenolic acids, and polyphenols. Besides there may be differences in the nutritional profile of walnuts as cultivar varies, it is due to be influenced by the cultivators, genotypes, climate, and soil conditions. (Taha & Al-wadaan, 2011)

Table 1: Nutritional Values vitamins of walnut (Juglans regia L.)

S.No	Vitamins	Quantity
1.	Folates	98 mcg
2.	Niacin	1.125 mg
3.	Pantothenic acid	o.570 mg
4.	Pyridoxine	0.537mg
5.	Riboflavin	0.150 mg
6.	Thiamin	0.541 mg
7.	Vitamin A	20 IU

8.	Vitamin C	1.3 mg
9.	Vitamin E-y	20.83 mg
10.	Vitamin K	207 mcg

As walnut oil has a great number of nutrition benefits which are triacylglycerols which are present in the concentration of 980 g / kg walnut oil. The High amount of monounsaturated fatty acids and can be defined as oleic acid and polyunsaturated fatty acid which can also be defined as α-linolenic acids and linoleic acid. Walnut oil is similar to soybean oil, but it has a higher concentration of linolenic acid. Walnut oil has the highest amount of PUFAs amongst all other vegetable oils. Walnut is good for health due to it has omega-6 and omega-3 PUFAs which are the key responsible for the several health benefits. Clinical studies have shown that omega-3 PUFAs are the key responsible for the prevention of coronary heart disease. Oils that are rich in oleic acid shows great oxidative stability which is used as frying purpose. All essential Amino Acid needs of the human adult can be full filled by Walnut proteins. Aspartate and glutamate have a high amount of walnut proteins. walnut mineral Composition paly's as cofactors for many enzymes due to its low sodium concentration. The mineral profile of walnut is listed in table no 2.

Table 2: Nutritional Values Minerals of walnut (Juglans regia L.)

S.No	Minerals	Quantity
1.	Potassium	441 mg
2.	Phosphorus	346 mg
3.	Calcium	98 mg
4.	Magnesium	158 mg
5.	sodium	2 mg
6.	Iron	2.9 mg
7.	Copper	1.5 mg
8.	Manganese	3.8 mg
9.	zinc	3.09 mg
10.	Aluminum	0.58 mg

An overview of walnut

Walnut (*Juglans regia* L.; Family: Juglandaceae) is a deciduous tree grown for its edible seeds. Walnut trees are large and vigorous with a wide-spreading canopy. The trunk of the tree can reach 2 m in diameter and mature trees possess smooth, silver-gray bark. Walnut leaves are composed of an odd number of smaller, oval shaped leaflets which are bright green in color. The tree produces male flowers on catkins and female flowers on terminal clusters where the fruit develops. The fruit of the walnut tree is a fleshy green drupe in which the nut is encased. The kernel of the nut is protected by a corrugated woody shell. Walnut trees can reach 25–35 m in height and can live for periods in excess of 200 years. Walnut may also be referred to as Persian walnut, English walnut, common walnut or European walnut and originates from central Asia.

Walnut (Juglans regia L) is a Non-Climacteric fruit tree grown in Which are grown in Jammu and Kashmir, Uttrakhand, and Himachal Pradesh, India. Walnut comes under fruit type "Nuts". Comes from a family "*Juglandaceae*" which initially originated in "Central Asia". Walnut having edible part "Cotyledon" which Has Chromosome no "2n = 32 ".The plant height is 10 to 40 meters tall. Walnuts are an important nut fruit that has several health benefits. The Tress which attain its giant size and which start bearing nuts from the tree of variables sizes and shapes which 10-15 years. The plants which are Vegetatively propagated will produce uniform size nuts within 4-5 years. Walnut may be termed as the most valuable exchange earning nut crop. "Walnut" is originated from "Wahlnut", which is an old English word for "Welsh-nut". Walnut is also known from different names like; "Akhrot" in Hindi, "Doon" in Kashmiri, and "Gardgani" in Unani. In Greeks, walnuts are called karyon, which means "Head", due to their shape resembles the human skull, and the walnut kernel its self looks like a human brain.

1.2 Market potential and export of raw material

Walnuts have been a good source of earning, Market potential of walnuts has been great on economics. The Global walnut market is projected to register a compound annual growth rate (CAGR) of 6.0 % over the forecast period of (2019-2024). Walnut's demands have been increased in food processing industries. Walnuts have been used to make new product recipes, in industries, for the development of nutraceuticals and cosmetic industries. It is been reported that India has exported 1,648.26 MT to the international market making the worth of

52.73Croroes/7.33 USD Millions During the year 2019-2020. Walnut from India has been exported to major countries like France, Germany, United Arab Emts. , Netherland.

1.3 Variety and types of walnut

There are many different varieties of walnuts , of which only three traditional varieties :

1. Black walnut *"juglans nigra"*
2. English or Persian walnut *"Jugans regia"*
3. White or butternut walnut "Juglans cinerea"

Flowering of walnut

Flower Separate Pistillate (Female)

Staminate (Male)

Popular varieties of walnut grown in India

1. CHIT Walnut-1
2. CHIT Walnut-2
3. CHIT Walnut-3
4. CHIT Walnut-4
5. CHIT Walnut-5
6. CHIT Walnut-6
7. CHIT Walnut-7
8. CHIT Walnut-8
9. CHIT Walnut-9
10. CHIT Walnut-10
11. Howard
12. Tehama
13. Chino
14. Chandler
15. Chakrata Selection
16. Sunland

1.4 Walnut importance and Utilization

Most parts of the plant are utilized in one or other way but fruit and timber has maximum use. Important fruit of the India being exported to more than 40 counties providing more than Rs. 300 Crore of foreign exchange annually.

Use of walnuts

Immature fruits utilized in production of pickles , chutneys , marmalades , press juice and syrups. Walnut oil for menstrual dysfunction. Walnut timber , used for craving , making furniture and butts of guns. Walnut shell flour used as diluents for agriculture insecticides. Walnut kernels used in confectionary and bakery items. Walnut used in cosmetic products.

Walnut Production

Production of walnut with shell in 2019 of world

Country	Area harvested (ha)	Yield (hg/ha)	Production (Tons)
World	1305349	34462	4498442
Oceania	11224	3893	4369
Asia	830484	38489	3196412
Africa	12243	27684	33893
America	309415	29470	911854
Europe	141983	24786	351914

1.5 Walnut processing

1. **Harvesting** : The Nuts are mechanically shaken from the trees. (Harvesting tools).

2. **Harvest Collection** : After Harvesting nuts fall on the ground, and picked up by windrows. (Mechanical collector tool)
3. **Drying :** Picked up harvest transported to holler drier, in which green outer husk or other material is been removed
4. **Washing :** Walnuts were washed to remove dirt and other material
5. **Drying :** After washing walnuts were dried to stable moisture around 8% by solar drying.
6. **To Processor (walnut with shell and walnut without shell) :** Walnuts are then delivered to the processor.

7. **To Grading :** The sizing step walnuts pass through a punched hole drum that has different size holes in it allowing different sized walnuts to fall through in the different bins.
8. **Washing :** Walnuts then go through one last water wash to remove any last debris
9. **Hand shorting :** Walnuts visually hand sorted
10. **Filler :** packaged into sacks the in-shell walnuts
11. **Packaging :** Packed and sealed in different weight and size.
12. **Shipping :** primarily shipped to export markets
13. **Walnut without shell (Grading) :** Grading is done according to walnut size
14. **Hauling :** Done mechanically with a double cylinder. Inner cylinder rotating with low RPM and outer cylinder fixed . Kernels falls at bottom of the cylinder
15. **Blowing :** Mechanical blowers were used to remove hull from the kernels
16. **Selection :** nuts are then categorized into sizes such as halves and pieces.
17. **Visual Inspection :** visually inspect the product by hand sorting the walnuts
18. **Filler :** packaged into sacks the walnut Kernels
19. **Packaging :** Packed and sealed in different weight and size**.**
20. **Shipping :** primarily shipped to export markets

CHAPTER 2

General Hygienic and Sanitary practices to be followed by Food Manufacturers

2.1 Sanitary and hygienic requirements for food manufacturer/ processor/handler

The place where food is manufactured, processed or handled shall comply with the following requirements:

1. The premises shall be located in a sanitary place and free from filthy surroundings and shall maintain overall hygienic environment. All new units shall set up away from environmentally polluted areas.

2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.

3. The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.

4. Floors, Ceilings and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.

5. The floor and skirted walls shall be washed as per requirement with an effective disinfectant the premises shall be kept free from all insects.

- No spraying shall be done during the conduct of business, but instead fly swats/ flaps should be used to kill spray flies getting into the premises.
- Windows, doors and other openings shall be fitted with net or screen, as appropriate to make the premise insect free.
- The water used in the manufacturing shall be potable and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.

6. Continuous supply of potable water shall be ensured in the premises. In case of intermittent water supply, adequate storage arrangement for water used in food or washing shall be made.

7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.

8. No vessel, container or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the preparation, packing or storage of food. (Copper or brass vessels shall have proper lining).

9. All equipments shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.

10. All equipments shall be placed well away from the walls to allow proper inspection.

11. There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.

12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.

13. Persons suffering from infectious diseases shall not be permitted to work. Any cuts or wounds shall remain covered at all time and the person should not be allowed to come in direct contact with food.

14. All food handlers shall keep their finger nails trimmed, clean and wash their hands with soap, or detergent and water before commencing work and every time after using toilet. Scratching of body parts, hair shall be avoided during food handling processes.

15. All food handlers should avoid wearing, false nails or other items or loose jewellery that might fall into food and also avoid touching their face or hair.

16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.

17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.

18. The vehicles used to transport foods must be maintained in good repair and kept clean.

19. Foods while in transport in packaged form or in containers shall maintain the required temperature.

20. Insecticides / disinfectants shall be kept and stored separately and `away from food manufacturing / storing/ handling areas.

2.2 FSSAI

The Food Safety and Standards Authority of India (FSSAI) has been established under Food Safety and Standards , 2006 which consolidates various acts & orders that have hitherto handled food related issues in various Ministries and Departments. FSSAI has been created for laying down science based standards for articles of food and to regulate their manufacture, storage, distribution, sale and import to ensure availability of safe and wholesome food for human consumption.

Highlights of the Food Safety and Standard Act, 2006

Various central Acts like Prevention of Food Adulteration Act,1954,Fruit Products Order , 1955, Meat Food Products Order,1973,

Vegetable Oil Products (Control) Order, 1947,Edible Oils Packaging (Regulation)Order 1988, Solvent Extracted Oil, De- Oiled Meal and Edible Flour (Control) Order, 1967, Milk and Milk Products Order, 1992 etc will be repealed after commencement of FSS Act, 2006.

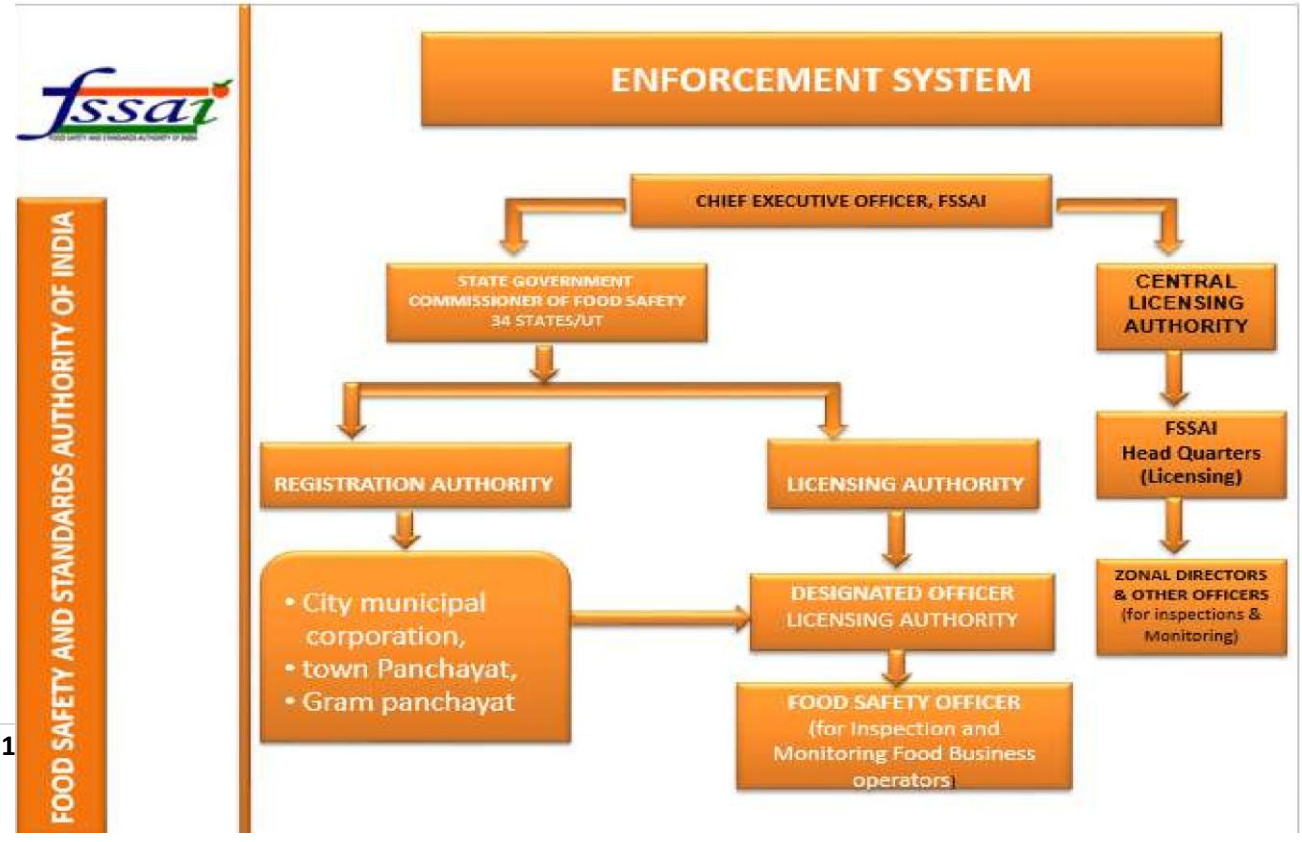
Establishment of the Authority

Ministry of Health & Family Welfare, Government of India is the Administrative Ministry for the implementation of FSSAI. The Chairperson and Chief Executive Officer of Food Safety and Standards Authority of India (FSSAI) have already been appointed by Government of India. The Chairperson is in the rank of Secretary to Government of India.

FSSAI has been mandated by the FSS Act, 2006 for performing the following functions:

- Framing of Regulations to lay down the Standards and guidelines in relation to articles of food and specifying appropriate system of enforcing various standards thus notified.

- Laying down mechanisms and guidelines for accreditation of certification bodies engaged in certification of food safety management system for food businesses.
- Laying down procedure and guidelines for accreditation of laboratories and notification of the accredited laboratories.
- To provide scientific advice and technical support to Central Government and State Governments in the matters of framing the policy and rules in areas which have a direct or indirect bearing of food safety and nutrition.
- Collect and collate data regarding food consumption, incidence and prevalence of biological risk, contaminants in food, residues of various, contaminants in foods products, identification of emerging risks and introduction of rapid alert system.
- Creating an information network across the country so that the public, consumers, Panchayats etc receive rapid, reliable and objective information about food safety and issues of concern.
- Provide training programmes for persons who are involved or intend to get involved in food businesses.
- Contribute to the development of international technical standards for food, sanitary and phyto-sanitary standards.
- Promote general awareness about food safety and food standards.



2.3 NEED FOR A FOOD CATEGORISATION SYSTEM

- Provides a clarity to all stakeholders including enforcement agencies.
- Provides predictability, certainty and direction through cataloguing the various food products in categories in a hierarchical manner.
- Enables easy Navigation by providing information in a clustered and clutter free manner.
- Provides a direction & space for future regulatory developments.

PRINCIPLES & CHARACTERISTICS OF PROPOSED FOOD CODE

- 1. This is a hierarchical orderly decision tree based approach.
- 2. It will be based on 4 level structure i.e.

a. Level 1: Main Category

b. Level 2: Sub Categories forming part of the main category

c. Level 3: Sub-sub Categories, forming part of a sub category

d. Level 4: Sub-sub categories or products, forming part of a sub-sub category

- 3. STRUCTURE: FCS shall be consisting of the following:
- a. Table 1 – Providing the Category headings
- b. Table 2 – Providing descriptions of Category headings
- c. Table 3 – Providing Full Category descriptions, including

Subcategory and sub-sub category descriptions

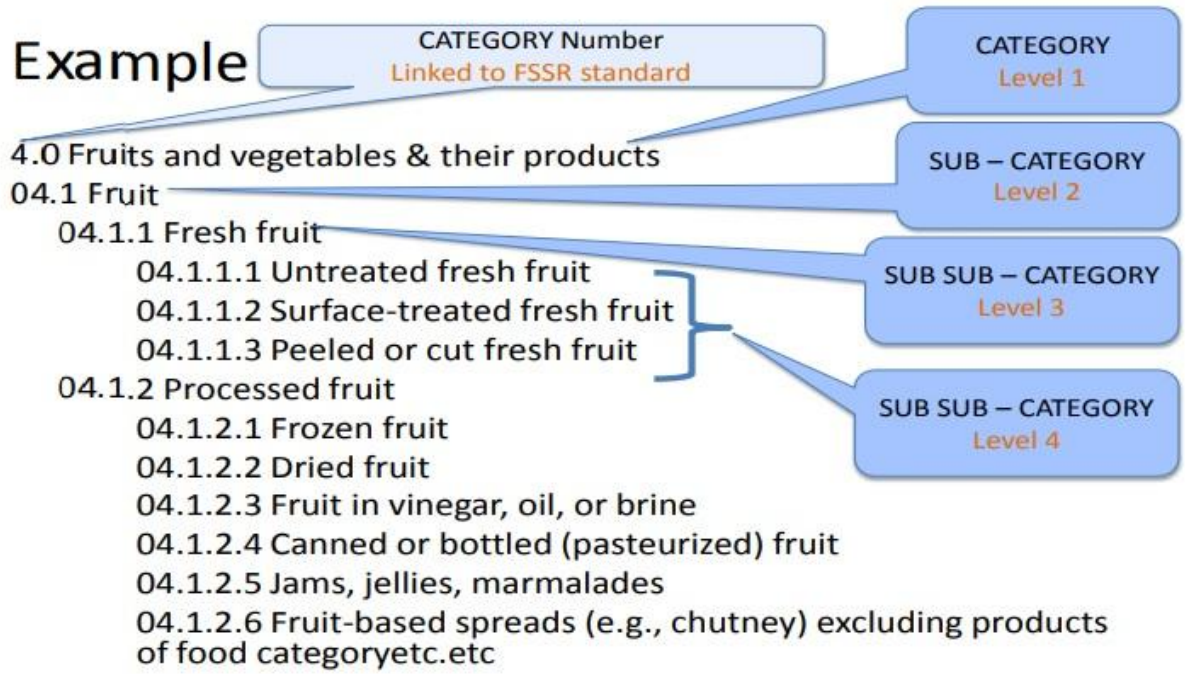
d. Table 4 - Current FSSR standards and their respective categories

- 4. Out of the above, Table 3 will also provide links to:
- i. Indian Standards (FSSR)
- ii. Products in Appendices (FSSR)
- iii. Include Indian examples (not included in FSSR)

5. FCS will be built around the 18 Main Categories to begin with, which includes category 1-16 of different food kinds. These will be supplemented with Category 17, to cover those products which can't be placed in categories 1-16 and a Category 99 has been created to deal with Substances added to food, such as vitamins, minerals, additives etc.

6. This categorization system will also help in orderly licensing/ registration of service sector, where service providing FBOs, such as retailers, transporters, storage and warehousing agents etc., will be required to just fill in the main categories which they are dealing with.

7. An example of the hierarchical nature is illustrated below:



2.3 Food License Registration Procedure

Any person or entity that does not classify as a petty food business operator is required to obtain an FSSAI license for operating a food business in India.

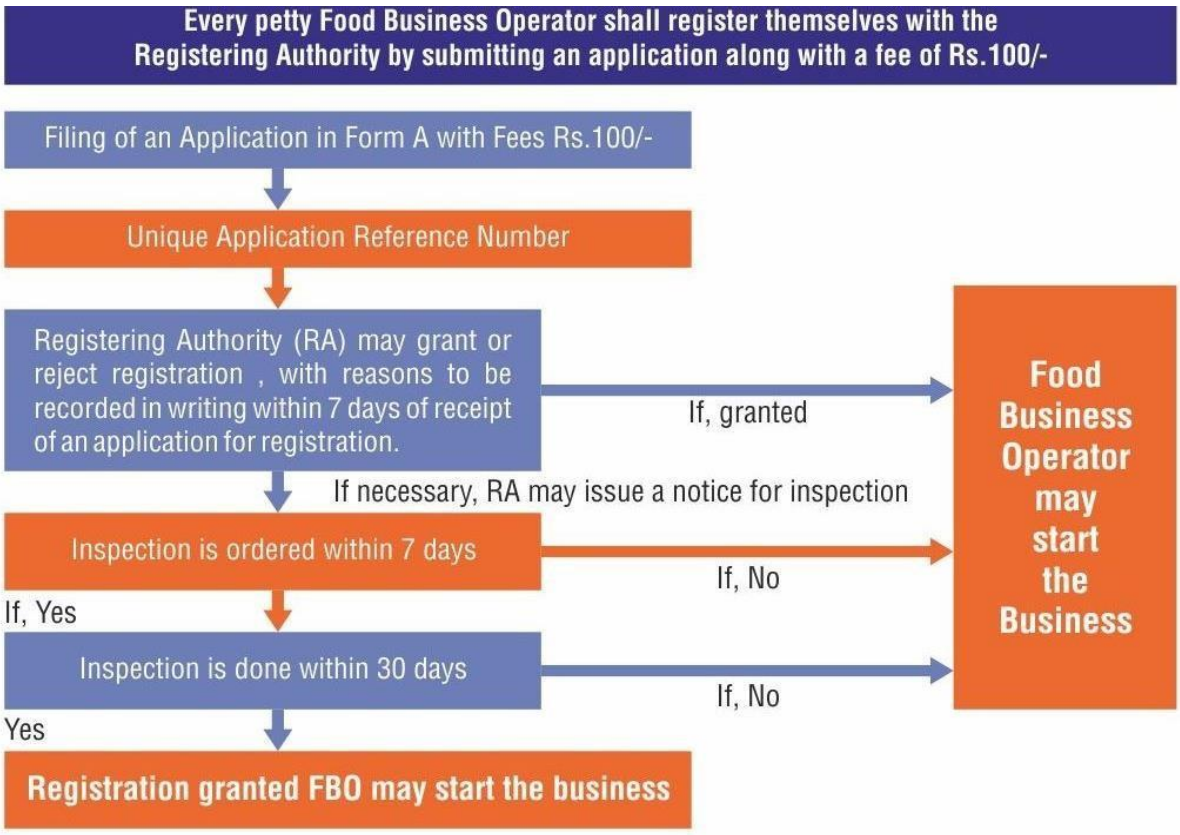
- ✓ FSSAI license is of two types,

  State FSSAI License and Central FSSAI License .

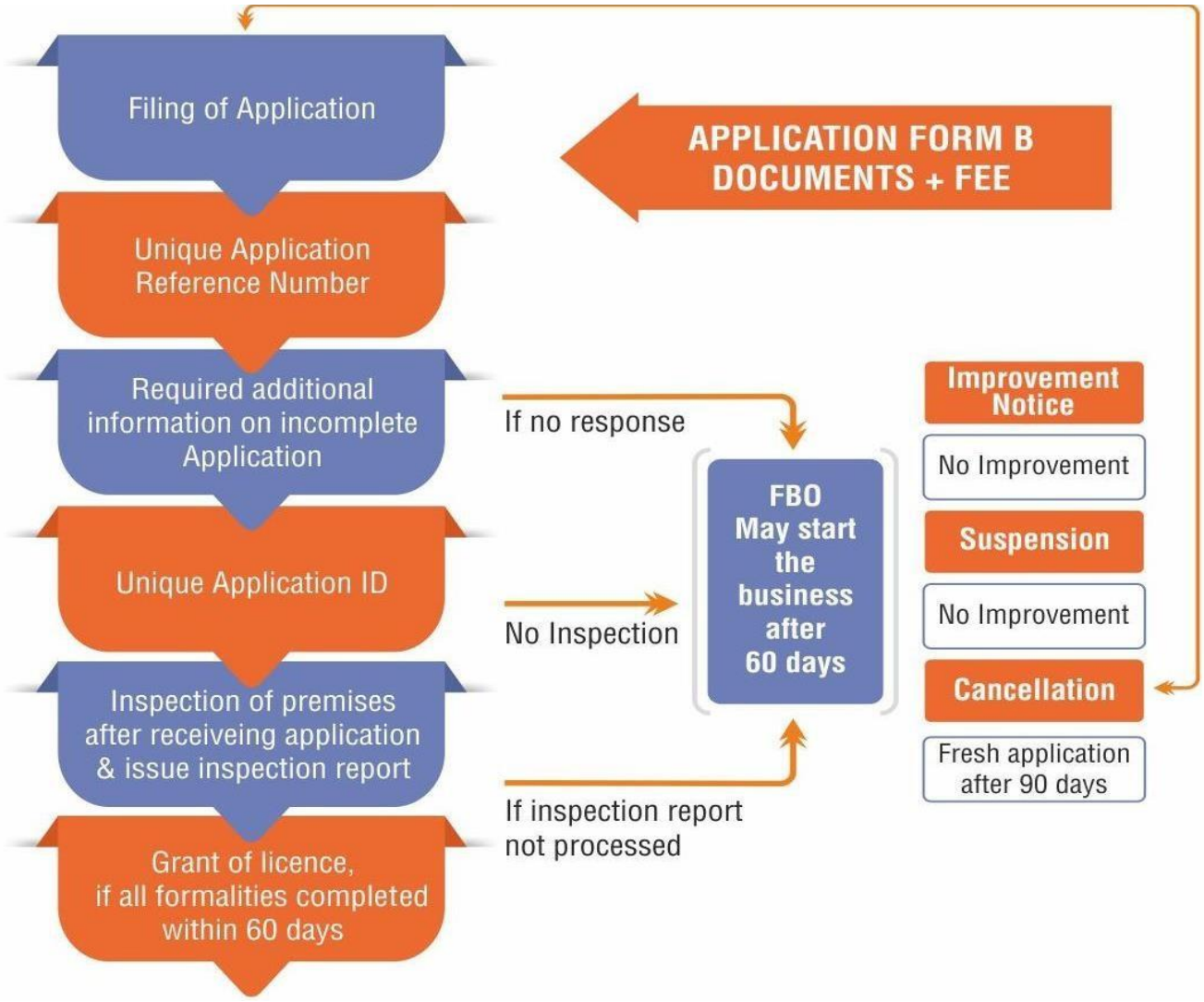
- ✓ Based on the size and nature of the business, the licensing authority would change.

- ✓ Large food manufacturer/processors/transporters and importers of food products require central FSSAI license;
- ✓ State FSSAI license is required for medium-sized food manufacturers, processor and transporters.
- ✓ The issuance of FSSAI license for a period of 1 to 5 years as a request by the food business operator. The higher fee would be applicable for obtaining FSSAI license for more years .
- ✓ If obtaining registration for one or two years, then the person can apply the renewal of license by making an application, no later than 30 days prior to the expiry date of the FSSAI license.

- https://fssai.gov.in/cms/licensing.php



Food License Registration Procedure



2.4 FOOD SAFETY COMPLIANCE SYSTEM (FoSCos)

- A new system launched by FSSAI –which is effective from 01.06.2020. This the best initiative taken by our Government for the best utilisation of the services provided by FSSAI in regulated manner.
- This new system has replaced the existing Food Licensing and Registration System (FLRS).
- FLRS has been used since 2011.
- Earlier application for getting Food License has been made on
- Till date, FLRS has issued 70 lakh licenses/registrations.

Features of FoSCos:-

- It is a cloud based, upgraded new food safety compliance online platform.
- It is a single window system where all facilities are available at one point of time.
- It has been integrated with FoSCos Mobile App.
- It saves lot of times while doing compliances regarding Food Safety.
- In coming days, it will soon also integrate with the present following IT Platforms of FSSAI :
- INFOLNet
- -FosTaC
- -FICS
- -FPVIS
- It will enable the GPS location tagging facility.
- It will also capture the picture in near future.
- RFID will also be utilised to ensure transparent and accountable extension field services such as inspections and sampling.
- It increases the Transparency & Accountability which is most important now days to boost the confidence among people.
- It will also integrated with other GOI's platforms such as GST,PAN,MCA etc., to ensure a 360 degree profiling.
- It will smooth the whole procedure of licensing, registration and compliance without taking so much time and in easiest way.
- Intially, following services will be offered by this new system:
    - Licesnsing
    - Registration
    - Inspection, &
    - Annual Return.
- Helpdesk facility is also available to clear the doubts and redress the grievance which is called "Licensing Help Desk".
- Grievance Holder may also contact FSSAI Helpline No.
- Doubts may be send at this Email Id: helpdeskfoscos@fssai.gov.in

2.6 Standards for walnut

- For Export and quality Below Specification are implemented

- ❑ Indian standard (IS : 7749-1975)
- ❑ UNECE STANDARD DDP-02 concerning the marketing and commercial quality control of WALNUT KERNELS 2002 EDITION (International trade)

For international trade (Export) of walnuts

For export of walnut from India to other countries, the documents which is needed as listed below:

1. Bill of landing/ Airway bill
2. Packing list of commodity
3. Commercial Invoice
4. Health certificate is required from export inspection council of India (EIA)
5. FSSAI license for export
6. Import Export Code (IEC) is required from DGFT (Directorate of Foreign Trade)
7. Certificate of conformity of product
8. Certificate of Origin

UNECE STANDARD DDP-02
concerning the marketing and commercial quality control of WALNUT KERNELS 2002 EDITION

- I. DEFINITION OF PRODUCE This standard applies to walnut kernels from varieties (cultivars) grown from Juglans regia L.
- II. PROVISIONS CONCERNING QUALITY The purpose of the standard is to define the quality requirements for walnut kernels at the export control stage, after preparation and packaging.

A. Minimum requirements

(i) In all classes, subject to the special provisions for each class and the tolerances allowed, walnut kernels must be:

- sufficiently dry to ensure keeping quality;

- sound; produce affected by rotting or deterioration such as to make it unfit for consumption is excluded;

- firm;

- sufficiently developed; shrivelled kernels are to be excluded;

- clean, practically free from any visible foreign matter and from shell;

- free from insects or mites whatever their stage of development;

- free from damage caused by pests ;

- free of any rancidity or oily appearance;

- free from mould; - free of abnormal external moisture;

- free of foreign smell and/or taste.

- The condition of the walnut kernels must be such as to enable them: - to withstand transport and handling, and
- - to arrive in satisfactory condition at the place of destination.

(ii) Moisture content The walnut kernels shall have a moisture content of not greater than 5 per cent.2

B. Classification

- Walnut kernels are classified in the three classes as defined below according to their quality and colour.

(i) "Extra" Class

- Walnut kernels in this class must be of superior quality, uniformly light-coloured with practically no dark straw and/or lemon-yellow colour and with no dark brown.
- They must be characteristic of the variety and/or commercial type5 . They must be practically free from defects with the exception of very slight superficial defects provided that these do not affect the general appearance of the produce, the quality, the keeping quality or its presentation in the package. Scuffing is allowed on:
- - quarters and all pieces,
- - halves, provided it covers no more than 10% of the surface area of the skin.

(ii) Class I

- Walnut kernels in this class must be of good quality, of a colour not darker than light brown and/or lemon-yellow.
- They must be characteristic of the variety and/or commercial type.5 Slight defects may be allowed provided that these do not affect the general appearance of the produce, the quality, the keeping quality or its presentation in the package. Scuffing is allowed on:

- - quarters and all pieces,
- - halves, provided it covers no more than 20% of the surface area of the skin.

(iii) Class II

- This class includes kernels which do not qualify for inclusion in the higher classes, but satisfy the minimum requirements specified above. Walnut kernels in this class must be of a colour not darker than dark brown. Darker kernels may be marketed in this class, provided the colour is indicated on the package. Defects may be allowed, provided that the walnut kernels retain their essential characteristics as regards general appearance, quality, keeping quality and presentation.
- This class also includes mixtures of kernels of different colours and designated in the marking by the words 'mixed colours'.
- Scuffing is not considered as a defect.

PROVISIONS CONCERNING SIZING (STYLES)

- Walnut kernels are classified by style as follows:
- (i) halves: kernels separated into two more or less equal and intact parts;
- (ii) quarters: kernels separated lengthways into four more or less equal pieces;
- (iii) large pieces: portions smaller than a "chipped kernel"6 but larger than a "broken piece";
- (iv) broken pieces: portions of kernels which can pass through a 8mm sizing screen but not through a 3mm sizing screen;
- (v) large pieces and halves: a mixture of kernels corresponding to the styles large pieces (iii) and halves (i) and of which the proportion of halves may be specified in the marking.
- The different styles are represented in the Annex relating to colour, shape and size.
- In addition to the designation of the style in the marking, an indication of the number of pieces per kg may be given optionally.

PROVISIONS CONCERNING TOLERANCES

- Tolerances in respect of quality, colour and type shall be allowed in each package for produce not satisfying the requirements of the class indicated.

A. Quality and colour tolerances

Defects allowed [a]	Tolerances allowed (per cent by weight of kernels)		
	Extra	Class I	Class II
(1) Kernels not satisfying the minimum requirements, which include not more than:	4	6	8
- Rotten kernels	0.5	1 [b]	2 [b]
- Mouldy kernels	0.5	1 [b]	2 [b]
- Shell fragments or foreign matter	0.1	0.1	0.1
(2) Kernels darker in colour,	8	9	10
(3) Scuffing (halves only)	10	10	-

[a] *The definitions of defects are listed in Annex II to this document.*
[b] *Reservation of Poland in favour of a tolerance not exceeding 0.5 per cent.*

B. Mineral impurities

- Not greater than 1g/kg acid insoluble ash.

C. Size tolerances (styles)

- For all styles, a minimum percentage of kernels corresponding to the style indicated in the marking is required and a maximum percentage by weight of kernels different from the style indicated is tolerated:

Style	Minimum percentage and tolerances allowed (per cent by weight of kernels)					
	Halves	Chipped kernels	Quarters	Large pieces	Broken pieces	Fragments
Halves	85[a]	15[b]	5[c]		1[c]	1[c]
Quarters			85[a]	15[b]	5[c]	1[c]
Large pieces				85[a]	15[b]	1[c]
Broken pieces				10[b]	90[a]	1[d]
Large pieces and halves	20 [b]			65[a]	15[b]	1[c]

[a] *Minimum percentage*
[b] *Tolerances allowed*
[c] *Included in 15% tolerance*
[d] *Included in 10% tolerance*

PROVISIONS CONCERNING MARKING

- Each package must bear the following particulars in letters grouped on the same side, legibly and indelibly marked and visible from the outside:

A. Identification

Packer) Name and address or

and/or) officially issued or

Dispatcher) accepted code mark

B. Nature of produce

- "Walnut kernels“

- Name of the variety or commercial type for AExtra@ class and class I where applicable (optional for class II).

C. Origin of produce

- Country of origin and, optionally, district where grown, or the national, regional or local place name.

D. Commercial specifications

- Class and optionally a commercial name; the words Amixed colours@ in class II where applicable;

- Style (Ahalves@, Aquarters@, Alarge pieces@, Abroken pieces@ or Alarge pieces and halves@) and optionally the number of pieces per kg;

- Crop year optional, mandatory according to the legislation of the importing country; - Net weight;

- Best before followed by the date (optional).

E. Official control mark (optional)

CHAPTER 3

3.1 Packaging Principle

- Packaging is indispensable to modern society . It allows a multitude of goods to reach the consumer undamaged , in a hygienic condition and with important brand and product information .
- Packaging is the science , art , and technology of enclosing or protecting products for distribution , storage , sale , and use.
- Packaging also refers to the process of design , evaluation ,and production of packages.
- Packaging may also be defined as the collection of different components (e.g. bottle, vial , closure , cap , ampoule , blister) which surround the pharmaceutical product from the time of production until its use.

Types of Packaging

Consumer Packaging

- Designed for consumer convenience and appeal, marketing consideration and display.
- The main emphasis is on marketing

Industrial Packaging

- Industrial packaging is focuses on the handling convenience and protection during transportation
- The main emphasis is on logistics

Types of packaging

Primary packaging

- Primary packaging is the material that first envelops the product and holds it. This usually is the smallest unit of distribution or use and is the package which is in direct contact with the contents.

- Examples : Ampoules , Vials , Containers , Dosing , Dropper , Closure (Plastic metal) , syringe , strip package , Blister Packaging .

Secondary Packaging

- It is outside the primary packaging perhaps used to group primary packages together .
- Example : Paper an board , Cartons , Corrugated Fiber , Box , etc

Tertiary Packaging

- It is used for bulk handling , warehouse storage and transport shipping . The most common form is a palletized unit load that packs tightly into containers .

3.2 Function of packaging

Primary Function	**Secondary Function**
Presentation	Containment
Protection	Identification
Preservation	Suitability
Economy	Labeling
Convenience	handling
Presentation	Containment
Protection	Identification

Factor for package design for international market

- Physical Characteristics
- Language , Colour and size
- Economy
- Container
- Convenience

3.3 Labeling and Marking

- The label is printer matters that appeals on the product package.
- Marking means putting some identification mark on the package during transportation

Types of Label

- Brand Label
- Grade label
- Informative label

3.4 Packaging Materials

1. Paper

- Paper and paperboard are sheet materials produced form and interlaced network of cellulose fibers derived from wood by using sulfate and sulfite.
- The Fibers derived are the pulped , bleached , and treated with chemicals and strengthening agents to produce the paper product.

2.Paper Board

- Paperboard is thicker that paper , with a higher weight per unit area , and is often made in multiple layers .
- It is commonly used to make containers for shipping , such as boxes , cartons and trays and is seldom used for direct food contact.
- There are several different types of paperboard , including white board , solid board , fiber board and chipboard.

3.Glass

- The production of glass containers involves heating a mixture of silica (the glass former), sodium carbonate (the melting agent) , limestone or calcium carbonate and alumina (stabilizers) to high temperatures util the materials melt into a thick liquid mass , which is then transferred to molds

4.Plastic

- Plastics are synthesized by condensation , addition or crosslinking polymerization of monomer units.

- In condensation polymerization , the polymer chain grown by condensation reactions between molecules and is accompanied by the formation of water or alcohol.
- The thermal and mechanical properties can be partially modified I order to manufacture retortable packages with plastics that have a high melting point , or thermostable packages making used of plastics with a low melting point and to develop very flexible structures (sachets and wrappings), semirigid structures (trays and tubs) and rigid structures (bottles, closures and tanks).
- Polymers can be classified into two types according to their behavior on heating: thermoplastic and thermosetting polymers

    1. Thermoplastic polymers soften and melt on heating and solidify again on cooling. They are easily molded and extruded into films, fibers and packaging. Examples include polyethylene, polypropylene and polyvinyl chloride.
    2. Thermosetting polymers, in contrast, become hardened on cooling, and these plastics retain their shape and cannot return to their original form. They are hard and durable. Thermosets include polyurethanes, polyesters, epoxy resins and phenolic resins.

- Thermoplastics are less rigid than thermosets.

Types of plastic:

• Various types: polyolefins, polyesters, polyvinyl chloride, polyvinylidene chloride, polystyrene, polyamide and ethylene vinyl alcohol.

• Polyolefins and polyesters are the most common.

5.METALS

- Metals are the most versatile of all forms of packaging. They offer the combination of excellent physical protection and barrier properties, formability, decorative potential, recyclability, and consumer acceptance.
- Metal containers are vacuum-sealed and thermally sterilized under low oxygen pressure.

- The decomposition of nutrients is kept to a minimum in metal containers, since metals are a perfect barrier to oxygen, light and moisture.
- The major limitations of metal containers are cost, the weight of the containers and the fact that they are difficult to crush. Aluminum and steel are the most predominantly used metals in food packaging.

Aluminium

- Aluminium is a lightweight, silvery white metal derived from bauxite ore, where it exists in combination with oxygen as alumina.
- Magnesium and manganese are often incorporated into aluminium to improve its mechanical strength
- Aluminium is highly resistant to most forms of corrosion; its natural coating of aluminium oxide provides a highly effective barrier to the effects of air, temperature, moisture and chemical attack.
- The mechanical, physical and chemical properties of aluminum foil such as its barrier effect, deadfold properties and suitability for food contact enable a wide range of applications in many different products and sectors
- The material is light but strong, can be formed and converted into complex shapes, has a high thermal and electrical conductivity, and can be recycled without decrease in quality.
- Aluminium foil is used for aseptic cartons, pouches, wrappings, bottle capsules, push - through blisters, laminated tubes, lids, trays and containers.

Tin plate

- Tinplate has been used for preserving food for well over a hundred years.
- Produced from low-carbon steel (that is, black plate), tinplate is the result of coating both sides of black plate with thin layers of tin.
- The coating is achieved by dipping the sheets of steel in molten tin (hot- dipped tinplate) or by the electrodeposition of tin on the steel sheet (electrolytic tinplate).

- The benefit provided by the bare tin surface inside the can is protection of the natural flavor and appearance of the food, through oxidation of the tin surface in preference to oxidative degradation of the food.

Tin-free steel

- This is also known as electrolytic chromium-coated steel or chrome-oxide-coated steel.
- Tin - free steel requires a coating of an organic material to provide complete corrosion resistance.
- Tin-free steel has good formability and strength, but it is much cheaper than tinplate.

3.5 PACKAGING METHODS:

1. ASCEPTIC PACKAGING:

- Process in which a food product, such as ultra high temperature (UHT) milk and its package is sterilized separately and then combined and sealed under sterilized atmosphere.
- It increases the shelf-life.

2. VACCUM PACKAGING

- It is a procedure in which air is drawn out of the package prior to sealing but no other gases are introduced.
- This technique has been used for many years for products such as cured meats and cheese.

3. Modified atmosphere packaging (MAP)

- Modified atmosphere packaging (MAP) is a procedure which involves replacing air inside a package with a predetermined mixture of gases prior to sealing it.
- The gases involved in modified atmosphere packaging, as applied commercially today, are carbon dioxide, nitrogen and oxygen.

- Carbon dioxide reacts with water in the product to form carbonic acid which lowers the pH of the food. It also inhibits the growth of certain microorganisms, mainly moulds and some aerobic bacteria.
- Nitrogen has no direct effect on microorganisms or foods, other than to replace oxygen, which can inhibit the oxidation of fats.
- Oxygen is included in MAP packages of red meat to maintain the red colour, which is due to the oxygenation of the myoglobin pigments.

4. ACTIVE PACKAGING

- Active packaging is an innovative concept that can be defined as a mode of packaging in which the package, the product and the environment interact to prolong shelf-life or enhance safety or sensory properties, while maintaining the quality of the product .
- It allows the active preservation of foods, according to their needs, by modification of the environment inside the package by removing undesired gases or by regulating the composition of the gas in the package headspace.
- Active systems can be classified according to their functionality as scavengers, regulators and emitters, and their action can be specific for several substances (O2 , CO2 , ethylene etc.).
- The internal atmosphere may be regulated by substances that absorb (scavenge) or release (emit) gases or vapors.

5. Edible Packaging

- Edible packaging is defined as a thin layer of edible material formed on a food as a coating or placed (preformed) on or between food components
- Natural polymers have been studied extensively for the development of edible packaging.
- A variety of polysaccharides (starch and hydrocolloids), proteins (whey proteins, soybean proteins and fish proteins) and lipids have been used, either individually or in mixtures, to produce edible films.

- Edible films and coatings have some advantages such as edibility, biocompatibility, barrier properties, absence of toxicity, the fact that they are nonpolluting, and low cost
- Moreover, biofilms and coatings, by themselves or acting as carriers of food additives (i.e., antioxidants and antimicrobials), have been considered particularly for food preservation because of their ability to extend the shelf - life .

6. Intelligent or Smart Packaging

- Intelligent, or smart packaging is basically designed to monitor and communicate information about food quality
- It is essentially an integrating method that deals with mechanical, chemical, electrical and/or electronically driven functions that enhance the usability or effectiveness of the food product in a proven way
- Some common examples of intelligent packaging are Time– Temperature Indicators (TTIs), ripeness indicators, biosensors and radio frequency identification (RFID).
- In addition, self-heating and self-cooling containers with electronic displays indicating use-by dates and information regarding the nutritional qualities and origin of the product in numerous languages are available in smart packaging
- These smart devices may be incorporated into packaging materials or attached to the inside or outside of a package.
- The FDA recognizes TTIs for fish products, so their importance may increase in the seafood industry.

7. Nano Packaging

- Nanoscale innovation could potentially introduce many amazing improvements to food packaging in the form of barrier and mechanical properties, detection of pathogens, and smart and active packaging with food safety and quality benefits
- Nanotechnology enables designers to alter the structure of packaging materials on the molecular scale, in order to give the material the desired properties.

- Different nanostructures, plastics can be given various gas and water vapor permeabilities to fit the requirements of various foods.
- By adding nanoparticles, one can achieve packages with more resistance to light and fire, better mechanical and thermal performance, and less gas absorption.
- These properties can significantly increase the shelf - life and sensory characteristics of food products, and facilitate transportation and usage.
- The addition of nanosensors to food packages could be used to detect chemicals, pathogens and toxins in foods

3.6 FASSI Regulations

Regulation 5.3.46 NUTS & RAISINS:

Dry Fruits and Nuts means the products obtained by drying sound, clean fruits and nuts of proper maturity. The product may be with or without stalks, shelled or unshelled, pitted or unpitted or pressed into blocks. The product shall be free from mould, living / dead insects, insect fragments and rodent contamination. The product shall be uniform in colour with a pleasant taste and flavour characteristic of the fruit/ nut free from off flavour, mustiness, rancidity and evidence of fermentation. The product shall be free from added colouring.

The product shall conform to the following requirements:-

(1)	**Extraneous Vegetable matter (m/m)**	**Not more than 1.0 percent**
(2)	Damaged/ Discolored units (m/m)	Not more than 2.0 percent
(3)	Acidity of extracted fat expressed as oleic Acid	Not more than 1.25 percent

Explanation - For the purpose of this paragraph –

(i) 'Extraneous vegetable matter' means stalks, pieces of shells, pits, fibre, peel;

(ii) 'Damaged or Discoloured' means units affected by sunburn, scars mechanical injury, discolouration and insects.

Packaging and Labelling Regulations

Part 4.1: Packaging Regulation 4.1.1:

General Requirements

1) A utensil or container made of the following materials or metals, when used in the preparation, packaging and storing of food shall be deemed to render it unfit for human consumption:—

(a) containers which are rusty;

(b) enameled containers which have become chipped and rusty;

(c) Copper or brass containers which are not properly tinned

(d) containers made of aluminium not conforming in chemical composition to IS:20 specification for Cast Aluminium & Aluminium Alloy for utensils or IS:21 specification for Wrought Aluminium and Aluminium Alloy for utensils

(2) Containers made of plastic materials should conform to the following Indian Standards Specification, used as appliances or receptacles for packing or storing whether partly or wholly, food articles namely :—

(i) IS : 10146 (Specification for Polyethylene in contact with foodstuffs);

(ii) IS : 10142 (Specification for Styrene Polymers in contact with foodstuffs);

(iii) IS : 10151 (Specification for Polyvinyl Chloride (PVC), in contact with foodstuffs);

(iv) IS : 10910 (Specification for Polypropylene in contact with foodstuffs)

(v) IS : 11434 (Specification for Ionomer Resins in contact with foodstuffs)

(vi) IS : 11704 Specification for Ethylene Acrylic Acid (EAA) copolymer.

(vii) IS : 12252 - Specification for Poly alkylene terephathalates (PET).

(viii) IS : 12247 - Specification for Nylon 6 Polymer;

(ix) IS : 13601 - Ethylene Vinly Acetate (EVA)

(x) IS : 13576 - Ethylene Metha Acrylic Acid (EMAA)

(xi) Tin and plastic containers once used, shall not be re-used for packaging of edible oils and fats;

2) General packaging requirements for Canned products

(i) All containers shall be securely packed and sealed

(ii) The exterior of the cans shall be free from major dents, rust, perforations and seam distortions.

- (iii) Cans shall be free from leaks.

PART 4.2: Labelling

Regulation 4.2.1:

General Requirements

1) Every prepackaged food shall carry a label containing information as required under these regulations unless otherwise provided;

2) Language of the particulars or declaration of the label: The particulars of declaration required under these Regulations to be specified on the label shall be in English or Hindi in Devnagri script:

3) Pre-packaged food shall not be described or presented on any label or in any manner that is false, misleading or deceptive or is likely to create an erroneous impression regarding its character in any respect;

4) Label in pre-packaged foods shall be applied in such a manner that they will not become separated from the container;

5) Contents on the label shall be clear, prominent, indelible and readily legible by the consumer under normal conditions of purchase and use;

6) Where the container is covered by a wrapper, the wrapper shall carry the necessary information or the label on the container shall be readily legible through the outer wrapper and not obscured by it;

Regulation 4.2.2: Labelling of Pre-packaged Foods

- Every package of food shall carry the following information on the label.

(1) The Name of Food: The name of the food shall include trade name or description of food contained in the package.

(2) List of Ingredients: Except for single ingredient foods, a list of ingredients shall be declared on the label in the following manner:-

- (a) The list of ingredients shall contain an appropriate title, such as the term "ingredients";
- (b) The name of ingredients used in the product shall be listed in descending order of their composition by weight or volume, as the case may be, at the time of its manufacture;
- (c) A specific name shall be used for ingredients in the list of ingredients;

(3) List of Ingredients:

Except for single ingredient foods, a list of ingredients shall be declared on the label in the following manner:-

- (a) The list of ingredients shall contain an appropriate title, such as the term "ingredients";
- (b) The name of ingredients used in the product shall be listed in descending order of their composition by weight or volume, as the case may be, at the time of its manufacture;
- (c) A specific name shall be used for ingredients in the list of ingredients;

(4) Veg/ Non veg declaration –

- (i) Every package of "Non Vegetarian" food shall bear a declaration to this effect made by a symbol and colour code as stipulated below to indicate that the product is Non-Vegetarian Food. The symbol shall consist of a brown colour filled triangle
- A green colour filled circle, having a diameter not less than the minimum size specified in the Table below, inside the square with green outline having side double the diameter of the circle, as indicated below :
- **(a) Green colour**

(5) Declaration of Food Additives:

For food additives falling in the respective classes and appearing in lists of food additives permitted for use in foods generally,

- The following class titles shall be used together with the specific names or recognized international numerical identifications:
- **(i) Acidity Regulator**, Acids, Anticaking Agent, Antifoaming Agent, Antioxidant, Bulking Agent, Colour, Colour Retention Agent, Emulsifier, Emulsifying Salt, Firming Agent, Flour Treatment Agent, Flavour Enhancer, Foaming Agent, Gelling Agent, Glazing Agent, Humectant, Preservative, Propellant, Raising Agent, Stabilizer, Sweetener, Thickener:

(ii) Addition of colours and/or Flavours-

- **CONTAINS PERMITTED NATURAL COLOUR(S) OR CONTAINS PERMITTED SYNTHETIC FOOD COLOUR(S) OR CONTAINS PERMITTED NATURAL AND SYNTHETIC FOOD COLOUR(S)**

CONTAINS ADDED FLAVOUR (specify type of flavouring agent)

CONTAINS PERMITTED NATURAL C0LOUR(S) AND ADDED FLAVOUR(S) OR CONTAINS PERMITTED SYNTHETIC FOOD COLOUR(S) AND ADDED FLAVOUR(S) OR CONTAINS PERMITTED NATURAL AND SYNTHETIC FOOD COLOUR(S) AND

ADDED FLAVOUR(S) OR CONTAINS PERMITTED NATURAL* /AND* SYNTHETIC* COLOUR(S) AND ADDED FLAVOUR(S)

(6) Name and complete address of the manufacturer

- The name and complete address of the manufacturer and the manufacturing unit if these are located at different places and in case the manufacturer is not the packer or bottler, the name and complete address of the packing or bottling unit as the case may be shall be declared on every package of food;

(7) Net content

- Net Content by weight or volume or number, as the case may be, shall be declared on every package of food; and

(8) Date of manufacture or packing.-

The date, month and year in which the commodity is manufactured, packed or pre-packed, shall be given on the label: Provided that the month and the year of manufacture, packing or pre-packing shall be given if the "Best Before Date" of the products is more than three months:

(9) Best Before

(i) The month and year in capital letters upto which the product is best for consumption, in the following manner, namely:—

(ii) "BEST BEFORE ..... MONTHS AND YEAR OR "BEST BEFORE ..... MONTHS FROM PACKAGING OR "BEST BEFORE .....MONTHS FROM MANUFACTURE

Walnut packaging

Walnut can be packed in two ways :

1. **walnut in shell**
2. **Walnut kernels**

Walnut in shell packaging

- Retort pouches
- Sack packaging
- Vacuum Packed in retort pouches
- Paper laminates

Walnut kernels packaging

- Vacuum packaging
- Tin packaging
- Glass jar packaging (chipped / powder)
- Retort pouches
- Paper laminates
- Plastic jars

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