

**PM Formalisation of
Micro Food Processing Enterprises Scheme**

**HANDBOOK
OF
PREPARATION OF PEANUT PRODUCTS**



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Abbreviations & Acronyms

Sr:No.	Abbreviations &Acronyms	Full Forms
1.	PM FME	Prime Minister's Formalisation of Micro Food Processing Enterprises Scheme
2.	HACCP	Hazard Analysis and Critical Control Point
3.	RDA	Recommended Dietary Allowance
4.	MUFA	Mono Unsaturated Fatty Acids
5.	USD	United States dollar
6.	FSSAI	Food Safety and Standards Authority of India
7.	FBO	Food Business Operator
8.	FLRS	Food Licensing and Registration System
9.	PFA	Prevention of Food Adulteration
10.	MoFPI	Ministry of Food Processing Industries
11.	FPOs	Farmer Producer Organizations
12.	SHGs	Self Help Groups

CHAPTER- 1

INTRODUCTION

The cultivation of the groundnut, worldwide expanded with the Mediterranean civilizations .originating from china, slowly spread towards china, Africa, japan, USA, India. Groundnut (*Arachis hypogea linn*) belongs to the family Leguminosae and subfamily pappillonaceae. Groundnut have a rich nutty flavor , sweet taste , crunchy feel and a comparatively longer shelf life over and over dry, clean and spotless groundnuts .Groundnut is India's largest crop of oil seeds and plays a significant role in bridging the country's vegetable oil deficit. As a result of a two-crop cycle harvested in March and October, groundnuts in India are available throughout the year. Ground nuts are significant protein crops that are mainly grown under rain fed conditions in India .Among Indian groundnut shellers and processors awareness and concern processors awareness and concern for quality is gradually increasing. Multiple storage and grading are increasingly becoming the standard , Indian farmers are able to prepare and supply edible peanuts that meet with the highest requirements.



1.1 Production

From 1980, the production increased rapidly ,China being the largest producer and exporter, exported about 637.4 million kilograms during the year 2008. The share of production in India during 2008 was nineteen percentage .Sudan comes first among the arab regions contributing much in area and production. (Ibrahim , 2006)

PM FME- Processing of Groundnut Products

At the end of the fiscal year, India produced more than 6 million metric tons of groundnut .

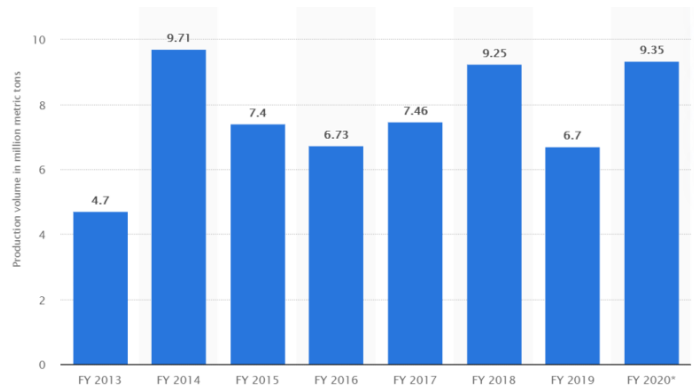


Figure 1. Production volume of groundnut across India from the financial year 2012 to 2019 (in million metric tons)

The statistical data by Daiela Coppola, 2020 shows that the export volume of the peanut worldwide, forecast that India exported about nine thousand metric tons of peanut oil.

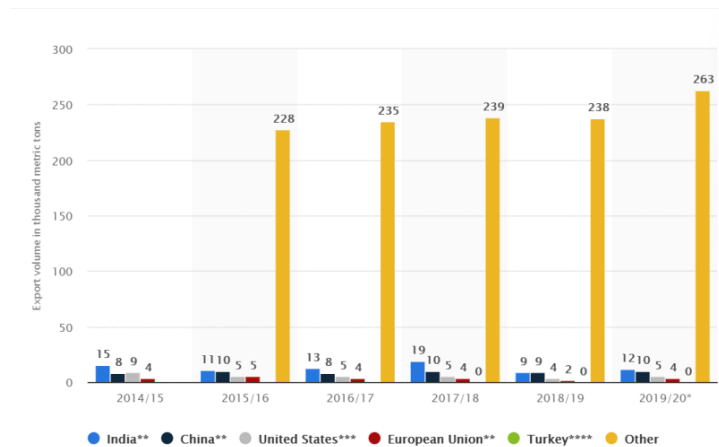


Figure 2. Export volume of the peanut oil from country to worldwide from 2015 to 2020 (in thousand metric tons)

The country has exported 6,64,442.93 MT of groundnuts to the world for the worth of Rs. 5,096.34 crores/ 711.38 USD Millions during the year 2019-20.

Major Export Destinations (2019-20) are Indonesia, Vietnam, Philippines, Malaysia, Thailand . (apeda)

PM FME- Processing of Groundnut Products

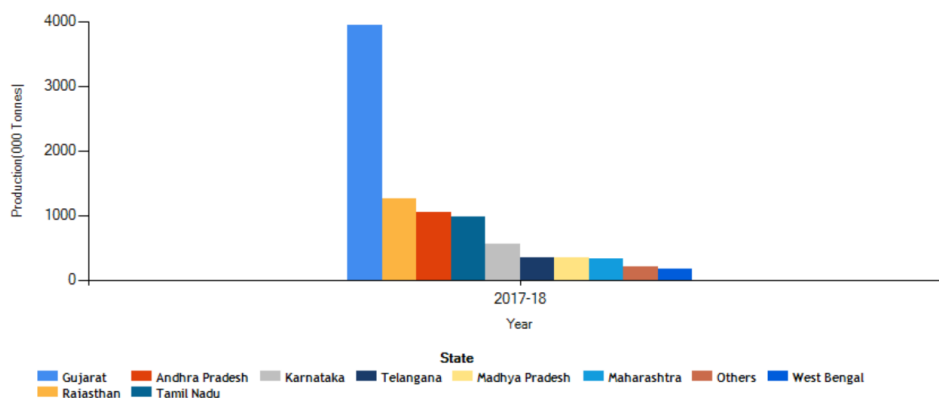


Figure 3. Top ten states in groundnut production

Sr no.	State	2017-2018	Production (Tonnes)
1	Gujarat	3,940	42.92%
2	Rajasthan	1,260	13.73%
3	Andrapradesh	1,040	11.33%
4	Tamilnadu	970	10.57%
5	Karnataka	560	6.10%
6	Madhya pradesh	350	3.81%
7	Telagana	350	3.81%
8	Maharshtra	350	3.59%
9	Others	210	2.29%
10	West bengal	170	1.85%

Table 1: Indian production of groundnut (Ministry of agriculture)

1.2 Major growing states

Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Rajasthan, Madhya Pradesh, Orissa, and Uttar Pradesh. (apeda)

1.3 Nutrition

Groundnut, rich in proteins, fat and other nutrients help in reducing weight loss and diminishing heart diseases. The nutritional requirement of ever-increasing mankind needs to be met by new plant foods (prakash and misra, 1988). To complement with the expensive nature of meat and meat products rich in protein, legumes and oilseeds are the only way.

PM FME- Processing of Groundnut Products

Groundnut are majority made up of protein, fiber, fat , vitamins etc. The protein serves as an excellent plant-based one , the unsaturated fat, as well as the compound carbohydrate, are also favorable to human nutrition (arya,et al)

Principle	Nutrient value	Percentage of RDA
Energy	567 Kcal	29
Carbohydrates	16.13g	12
Protiens	25.80g	46
Total Fat	49.24g	165
Cholestrol	0mg	0
Dietary fibre	8.5 g	22
Calcium	92mg	9

Table 2: Groundnuts (*Arachis hypogaea*), All types, Nutritional value per 100 g(USDA national nutrient database)

Protein

According to peanut institue, the protein conent of 1 ounce groudnut raw is 7.3g. 20 amino acids are present in groundnut in variable amounts and arginine is found in abundant. (USDA 2016). The PDCAAS (Protein digestibility corrected amino acid score) of Groundnut is similar to egg and meat reported by FAO, 2002. The unique bioactive in the plant proteins keep the groundnut proteins to have excellent rheological properties. Nowadays, peanut protein has been incorporated into infant formula, noodle and pasta etc.

Fibre

The dietary fibre in groundnut accounts for about 2.4g in 102 as per USDA. A 100g of peanut has 8.5 g of dietary fibre. Insoluble fibres are mainly present in peanut

Fat

As reported by peanut institute in nutritional data, the raw peanut (102), contains a total fat content of 14g MUFA. Mufa 6.9 g, PUFA 44g. (Peanut institute)

As per the American peanut institute, peanut fat profile contains 50% of MUFA, 14% of UFA, the amount of MUFA reduced the total cholesterol by 11% and bad LDL cholesterol by 14% maintaining the HDL .(Pikeman, 2004)

Vitamins

According to peanut institute, the vitamin content is 2.4mg80, folate 69mcg, niacin 3.4 mg, thiamine 0.18mg, riboflavin 0.04 mg, pantothenic acid 0.5 mg, vitamin B6 0.10 mg. A 100-gram peanut can be used to attain a 75% RDA of niacin, 60% RDA of folate, 53% of thiamine, 27% RDA of pyridoxine, 35% RDA of Pantothenic acid. (USDA). The vitamin E abundantly present will reduce coronary heart diseases and the folate helps in infancy and pregnancy. (Arya *et. al.*)

Minerals

Calorie

The calorie of 102 of peanut is about 161 kCal to peanut institute. It is energy-dense compared to other legumes.

1.4 Health

The realization of the effectiveness and efficiency of groundnut and its products can lead to a major consumer acceptance and utilization. The functional properties of the popular legumes have to be explored for further wildy acceptance. (Giami , 1993)

Cholesterol lowering

Add from fat, the health gains from the peanut diets on the cholesterol was similar to olive oil. The groundnut intake and the percentage of the MUFA had greatly reduced the rate of coronary heart diseases. (Matilskey *et. al.*)

The malnutrition infant can be supplied with healthy calorie diets with peanut and peanut butter. (Arya *et. al.*)

Diabetes

The peanut carbohydrate is constituted mostly by sucrose and starch and less by reducing sugars. Thus, it has a low GI and low glycine load. (Foster and Powell 2002). The analysis shows GI is 14 and GL is 1 for peanut. Peanut containing fibers, heart healthy oils, and magnesium doesn't badly affect the blood glucose level. (Arya *et. al.*)

Alzheimer disease

The high amount of niacin can account for the conversion of food to energy. The proper functioning of the digestive system, skin, nerves and supposed to protect against Alzheimer's disease. (Morris, 2002) The abundance of minerals leads to a reduced risk of metabolic syndrome and type 2 diabetes. (Larson and Walk, 2007)

Regulation of weight

Important data indicates that the addition of peanuts in the diet, peanut butter does not contribute to weight gain. In the analysis linked to Diets incorporated with peanuts, for weight loss Butter and peanut oil are more acceptable in the population (Arya, et al, 2007)

Hunger maintenance

Study results indicate that intake of peanut and peanut butter increased the feeling of fullness and pleased customers more than snacks of carbohydrates such as cakes in equivalent amounts. Another Such Analysis found that intake of peanuts curbed the appetite. In peanuts, monounsaturated fat can stimulate a hormone that helps to be comfortable after intake. (Arya, et al, 2007)

Peanut digestibility

The % of digestibility and the amino acid profile, gives the idea of protein quality. After analysis, the PDCAAS of peanut was found to be about 0.70/1 which was higher to meat. (Arya, et al, 2007) About half the content of MUFA accounts for the early easy digestibility of fat. The ANF phytic acid present in groundnut is lower than other legumes. (Shimmer, 2009). The soluble fibre is less in peanut and does not interfere in the absorption of nutrients.

Antinutritional factors

Trypsin inhibitor present in groundnut can lead to pancreatic hypotrophy. Lectins are also present in groundnut, but the processing steps like roasting doesn't affect the lectin level. Groundnut is highly allergic nature and hypersensitivity to children. The flatulence causing

nature is also noticed. So it is always better to consume fried/boiled/roasted groundnut apart from raw groundnuts.

Atherosclerosis

Groundnut is connected to atherosclerosis, the triacylglycerol structure seems to be a potential reason for atherosclerogenicity of the groundnut. (fao)

Bioactives in peanut

Peanut kernels are rich in bioactives :

- **p-Coumaric acid** The main antioxidant in peanuts
- **Resveratrol.** a powerful antioxidant helps in reducing cardiovascular disease and cancer
- **Isoflavones.** class of polyphenols associated with much health effects
- **Phytic acid.** Delibilate the absorption of fe and zinc
- **Phytosterols.** Delibilate the absorption of cholesterol in the digestive tract (tnau agritech portal)

1.5 Variety

Tag 24 : bunchy type, mature in 110 days . The average yield is 25 q / ha. A shelling percentage is 72 %. Oil content is 53%. Resistant to bud necrosis and leaf spot .

ICGS 11 : bunchy type, mature in 125 days. The average yield is 25 q / ha. A shelling percentage is 70 %. Oil content is 53%. Plants are dwarf with dark green leaves.

TMV 2 : bunchy type, mature in 115 days. The average yield is 16 q / ha. A shelling percentage is 70 %. Oil content is 51%. Moderately resistant to early, late leaf spot and rust dormancy absent.

PM FME- Processing of Groundnut Products

AK12 – 24 : bunchy type, mature in 105 days. The average yield is 16 q / ha. A shelling percentage is 70 %. Oil content is 48%. Resistant to leaf spot and rust , Seeds rosy in colour having no dormancy.

OG52 -1 : bunchy type, mature in 110 days. The average yield is 25 q / ha. A shelling percentage is 72 %. Oil content is 51%. Kernal bold, red in color, resistant to collar rot and stem rot, dormancy absent.

TAG 24: bunchy type, mature in 110 days. The average yield is 25 q / ha. A shelling percentage is 72 %. Oil content is 53%. Resistant to bud necrosis.

(Kisansuvidha)

The peanut is not a nut ,but rather a legume , considering its name and appearance. India is the world's second-largest maker of groundnuts. There are various varieties of Indian groundnuts available: Bold or Racer, Java or Spanish, and Red Natal. Kadiri-2, Kadiri-3, BG-1, BG-2, Kuber, GAUG-1, GAUG-10, PG-1, T-28, T-64, Chandra, Chitra, Kaushal, Parkash, Amber are the major groundnut varieties produced in India.(apeda)

1.6 Losses – Pre-harvest and Post harvest

- Pre-harvest losses due to diseases and pest
- Losses due to weeds
- Brought and yield loss
- Losses due to nutrient deficiencies
- Losses due to peg drying
- Storage losses

1.7 Grading and Storage

Groundnut is divided into four types

Runner – used for a variety range of products since it is larger in size

Virginia – largest kernels , preferred for the preparation of the roasted groundnut and eaten as in shell directly, also preferred for the confectionery products .

PM FME- Processing of Groundnut Products

Spanish – small kernel with reddish-brown skin , groundnut candy and groundnut butter is made by using this type of nut. Contains the quite larger amount of oil.

Valencia – very sweet variety of groundnut, excellent for the fresh use as boiled groundnuts , roasted and sold in the shell.

In the national and international markets the aspects like foreign material (4%), moisture (7%) , damage (1%), loose shelled kernel content, split nuts (4%) resolve the value of the product. Seed size , 100 seed weight are also the factors that determine value and quality of nuts , which may vary with genotype. For preparing export quality edible groundnut “handpicking and selection “ HPS”

There's already hired labor in operation. Even though human endeavor is deserving of the Indian background, The need to mount mechanical graders will not be resolved with respect and motivation Highlighted. The use of groundnut grading machines would not only be quicker and more efficient. But still a hygienic one. At present, optical sorting system grading is not used.

Characteristics	Requirement for milling		
Damaged kernals and weevil kernals by %by weight (max)	1	2	3
Split and broken kernals% by weight	5	10	15
Impurities % by weight	1	2	3
Moisture content by weight	6	6	6

Table 4: ISI specification for groundnut kernels for oil milling



Storage

After the commercial analysis of the various conditions of storage of groundnut particularly in India , there are some recommendations put forward as :

- The products which are expected to be stored, must be dried to a maximum of 5% moisture content.
- It is better to store as pods than as kernels.
- The caking up of the kernels and devastation of the gunny bags can be avoided by using dry sand bedding to a depth of about 1 foot covered by hessa cloth rather than storing in hard floor/bedding materials.
- Bins are the best choices for storage
- Miniature warehouses with natural ventilation and semi-underground storage can be utilized. (fao)

CHAPTER – 2

PROCESSING AND MACHINERY REQUIREMENT

2.1 Importance of processing

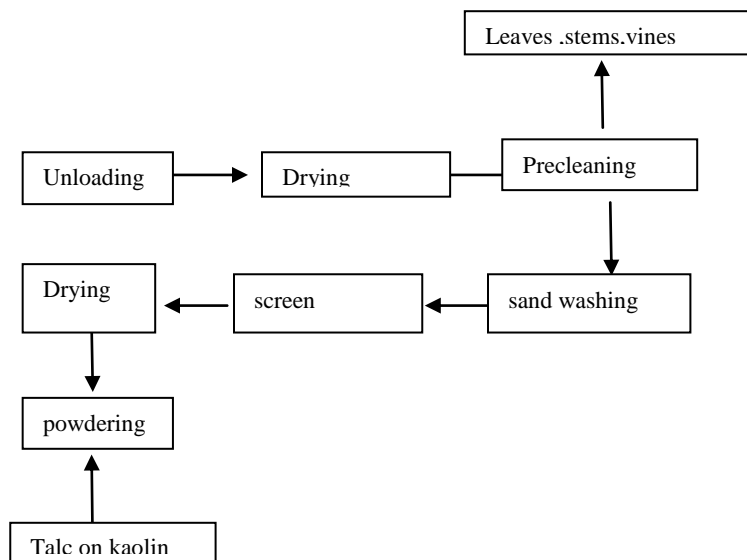
Groundnut is mainly processed by developing countries for oil. The cake out of the oil production is still not utilized to full amount. The serious problem faced by the groundnut producers are the aflatoxin, by *aspergillus flavous* . lower prices paid for the kernel and pods made it essential to diversify production and produce more value-added products. Drying , storage facilities have to be improved in many countries. Along with that operations like curing , drying, storage with processing technologies need to be improved. (apeda)

2.2 Processing

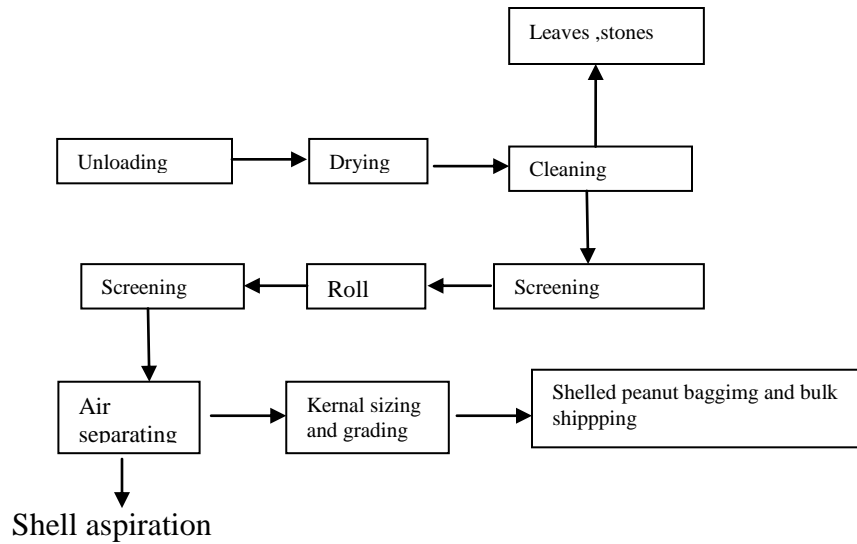
After the post harvest operation like curing , cleaning , the groundnut is processed for oil production ,roasting and peanut butter production mainly processing is done for inshell consumption and other uses.

In shell processing

Priimarily the external materrs are removed using blowers and screens . discoloration, stains are eliminated by washing . The groundnut are powdered with talc or kaolin after drying.



Flowchart 1: Typical in-shell peanut processing flow diagram.



flowchart 2 : Typical shelled peanut processing flow diagram

Shelling

Cleaned pods passes through size graders followed by crushing the hull. Rollers are used to crush the shells of the peanut. In some cases rotating beater is also used along with drum rollers the oscillating shaker will then separate the crushed shells and peanut kernel. The separation process is followed by grading (hand, electric sorter). discoloration can be identified and separation of the color grades is done.

Roasting

Roasting is the preliminary step done for the peanut meant for either packaging and further processing (candies / peanut butter).

Roasting can give a special flavor for peanuts. Roasting dries the peanut more and gives a brownish tinch to the nuts. (woodroof, 1983)

2.3 Products

Groundnut occupies a unique position among the world's principle oilseed crops. The way it can be consumed directly and various otheer ways made it this unique. (Ibrahim, 2006). Groundnut is well utilized in India for the expulsion of oil. (Carley and Fletcher, 1995). The extracted oil is used in cooking whereas the leftover from the expulsion is further undergone

PM FME- Processing of Groundnut Products

purification and converted as supplementary food mixes. The inexpensive nature of the nut can be utilized in order to mix it with other kinds of nut not compromising the flavor and nutrition. (Ibrahim, 2006).

Groundnut oil, roasted groundnut, roasted paste, boiled, etc are the major products. Hull represents about 25 % of total mass production is used as cattle feed and poultry feed . In india industrial processing of oil is prevalent. countries like Sudan, Nigeria Senegal also process groundnut oil. The uses include as a cooking medium, hydrogenated into vanaspati etc. groundnut cake with forty three to sixty-five percent protein is the by-product of oil extraction. it also has high amount of fat and b group vitamins . China, India, Argentina, Brazil, Indonesia are the major countries producing oil and cakes (Fao)



The major products produced includes boiled or roasted peanuts, edible oil (with higher smoke point). Peanut butter by grounding the seeds is also a best product made out of groundnuts. There are about 300 derivative products made from groundnut .

Derived products

Protein meal – the the cake is powdered and defatted again via solvent extraction .Protien meal got as the by product of crushing is used as the livestock feed.Processed food and snacks is made out of the peanuts.The roots can enrich the soil and the vine can be used as fodder.

2.3.1 Roasted Groundnut



Roasting

Dry roasting - Dry roasting is either a batch process or a continuous one . Batch roasters offer the benefit of improvement of peanut stocks from storage with various moisture contents. Usually, batch roasters are natural gas-fired rotating furnaces (drum-shaped).The oven's rotation constantly stirs the Peanuts to make a roast . Oven temperatures are around 800 °F (430 ° C) and peanut temperature from 40 to 60 minutes, the temperature is increased to around 160 ° C.

Continuous dry roasters

Differ dramatically in form, continuous roasting decreases labor, guarantees labor, and ensure that for other processes (packaging, processing of sweets, peanut butter), a constant supply of peanuts which avoids spillage. Peanuts are fed into a stream of peanuts in one form of roaster by a conveyor.

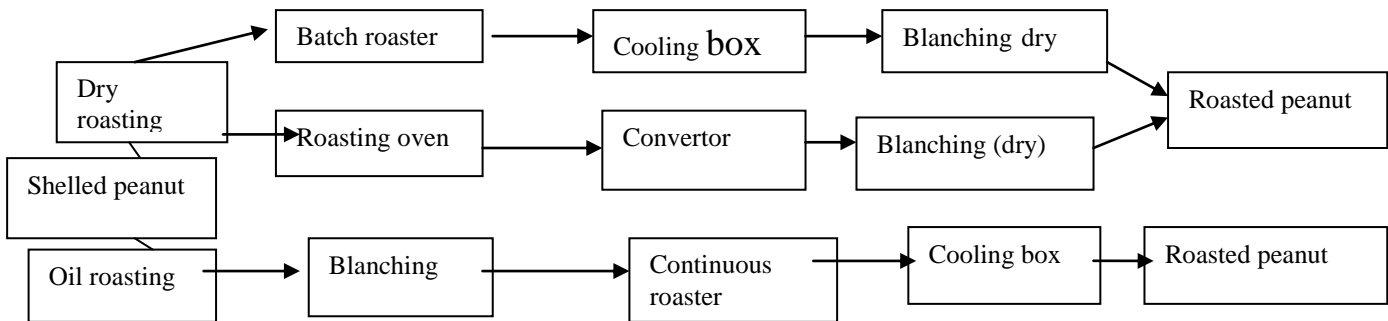
The hot air counter current that roasts the peanuts.Dry peanuts that have been roasted are cooled and blanched. Cooling takes place either in cooling boxes or immediately after roasting, Conveyors where massive amounts of air are blown ove the peanuts. To stop the process of roasting and preserve consistency, cooling is required. Blanching removes peanut skin, as well as ashes, moulds and other imported ingredients.There are many blanching system. Dry, water, spin, and air effect approaches. Dry blanching is mainly used in the processing of peanut butter , since the kernel eliminated.

Heat affects the taste of peanut butter .The peanuts are heated to about138 ° C .Dry blanchin g to break and relax the skin for 25 minutes. And the hot peanuts are cooled and handed over. Ru b off the skins by either brushes or ribbed rubber belting. Screening is used to divide the Cotyled ons.Water blanching passes by stationary blades that slit the peanut through the peanuts on conve yors. SkinsWith hot water sprayers, the skins are then loosened and separated by passing the pea nuts under on knobbed conveyor belts, oscillating canvas-covered pads.

The blanching of water involves drying to a moisture content of 6 to 12 percent for peanuts. To remove the skins of the peanuts, spin blanching utilizes steam. Steaming is followed by spinning. As the peanuts pass, the peanuts rotate on rotating spindles, single file, down a grooved conveyor. The peanut skins are unwrapped by spinning. The blanching of the air impact uses a horizontal drum in which peanuts are placed and Rotated. The inside side of the drum has an abrasive surface that helps to extract the skin as much as possible. There are air jets inside the drum that blast the peanuts toward the drum's movement. To create an air that effect that loosens the skin. The mixture of the impacts of air and the abrasive surface. The drum results in the elimination of skin. It is possible to conduct either batch or continuous air effect blanching

Roasting the groundnut by the addition of one to four percent of salt is usually seen all over the world. Standardization of the traditional roasting process is essentially based on the 4 criteria like moisture content, the character of peanut butter. According to Patel et al, the roasting of kernels at an elevated temperature like 90°C and 110°C was under roasted. Also, there were no colour, flavour change for the skin, moreover, the skin cannot be removed. (patel and dhamsaniya)

The mature groundnuts were soaked in saline solution and then either by applying dry heat or vegetable oil, it is roasted .(FAO)



Flowchart 3 : flowchart of roasting peanut

2.3.2 Packaging

Roasted peanut can be packed in plastic pouches, plastic jars, aluminium pouches etc

2.3.3 Shelflife

The shelflife of roasted peanut is about 6- 9 months in pantry and about one year in cold storage

Difference in processing conditions

The analysis showed that a temperature of 150°C for 60min and 170°C for 45 and 60 min were found over-roasted .

The analysis revealed for minimum moisture content the groundnut kernel should be roasted at lower temperature and high time.

The minimum Water activity of 0.54, for higher stability during storage with the lesser microbial attack, was shown by the peanut roasted at 130°C for 70min.

Sensory analysis conducted revealed that the peanut kernels roasted at 130°C (60min) gave a pleasant odor. The PNB at the same range showed superior color compared with elevated temperatures and lower time. The taste of the PNB made by roasting the peanut kern at 130°C for 60 min was much superior to the other time-temp combination. Poor taste is shown by the PNB produced by roasting peanuts at a high temp. The better smell, the pleasant odour was given by the same time-temperature combination. Overall acceptability was also higher for the PNB prepared by roasting the kernel at 130°C for 60 min.

2.3.4 Machineries Required



Pan roaster



Automatic seasoning system

2.4 Peanut oil



Extraction of oil from groundnut is mainly done via three methods like hydraulic pressing, solvent extraction and screw pressing.

2.4.1 Power Ghani mill

Ghani consisting a motor and a pestle has been modernized for years. Improved version of ghani developed in India, Wordha Ghani has the capacity of up to 15kg in 1.5hr or 100kg/d. Technical advantages have improved the power of the Ghani replacing bullock or manpower.(ILO,1990)

Oil extraction by pressing

Double Ghani , mill with 3 Horsepower motor , each ghani with a capacity of about 35kg in an hour. Capacity is about 560kg/d. After extraction, filtration of impurities is done by ordinary cloth, followed by settling of oil.

Advantages of ghani mill

Ghani have a maximum capacity of about 50kg per day. Modern powered units compared to the traditional ghanis have a maximum capacity of about 50kg each day. The training of the animals, their feed, as well as the running cost, are the hindrance to the usage of ghanis. The oilcake which comes out of the traditional ghanis is much harder.

2.4.2 Baby expeller mills

Baby expeller mills with a capacity of 45-55kg/hr can process about 350-450kg of raw groundnut per day. Drying is essential before crushing.

Crusher of swing beater type is preferred with a capacity of a hundred kilogram. The expeller mill works in a temperature range of 60- 90°C for 30-35min.

There should be mechanical stirring before extraction and also cooking and scorching are essential. It will enhance the oil extraction, regulate water in the seeds and minimize the wear in the screw press. The maximum temperature should not go beyond 120°C, above that the protein quality is much affected. Groundnut kernels can get damaged due to improper care at the time of cooking or scorching of the seeds.

Oil extraction by pressing

Oil extraction by pressing can be done by a single, double expeller. A pulley and belt or motor-driven expellers are commonly used with economic conditions, sometimes second pressing can be done; it usually increases the rate of oil extraction.

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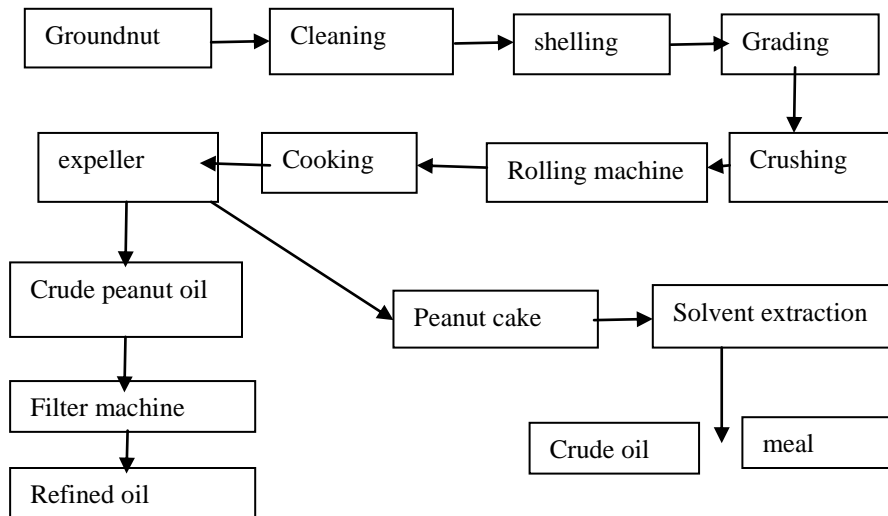
It is necessary to add the groundnut shells to the kernels in case of small expeller, to prevent the formation of groundnut butter. Skilled labor and maintenance are necessary for the proper shelf life of the various expellers.

Filtration

Filter press with 10 plates of area 324 square meters can be used, attaching to a pump(0.5hp). Similar presses can process up to 50 litres per hour. Paper and filter clothes can be used for filtration.

Solvent Extraction plant

The residual oil of about 6% from the expeller cake can be recovered using the solvent extraction. Apart from a small-scale production plant, it is best suited for a large-scale extraction. 50 - 200 tons per day is the avg production. A better high capacity running rate must be facilitated by a great supply of oilseed as well as a good cake collection system.



Flowchart 4 : Groundnut Oil Processing Flowchart

2.4.3 Effect of processing factors on oil yield

The difference in the oil yield of the coarsely ground and finely ground samples was analyzed and found that coarsely ground groundnut produced higher oil than finely ground. The particle size of the groundnut expressed at 10-15mpa is highly dependent than at a pressure level of 20-25mpa. Lower particle size gave better results at lower pressure since that pressure provided an easy way for the oil flow. As the pressure increased beyond 25 the capillaries were sealed.

The samples were heated for 15-25 mins, on increasing the temperature the oil yield increased but as the time increased to 45 min, there was no effect in the oil yield. The yield at higher temperatures wasn't dependant on the time of heating.

The color of the oil increased with increased temperature and time of heating. Along with that the elevated time, temperature combination also increased the free fatty acid content, peroxide value.

2.4.4 Machineries Required

1. **Vibratory Pre-cleaner machine:** -The machine is used to discard foreign impurities like husk, stone, plastic from the peanuts. The machine works on the principle of gyratory vibrations and separates the peanuts on the basis of their particle size.

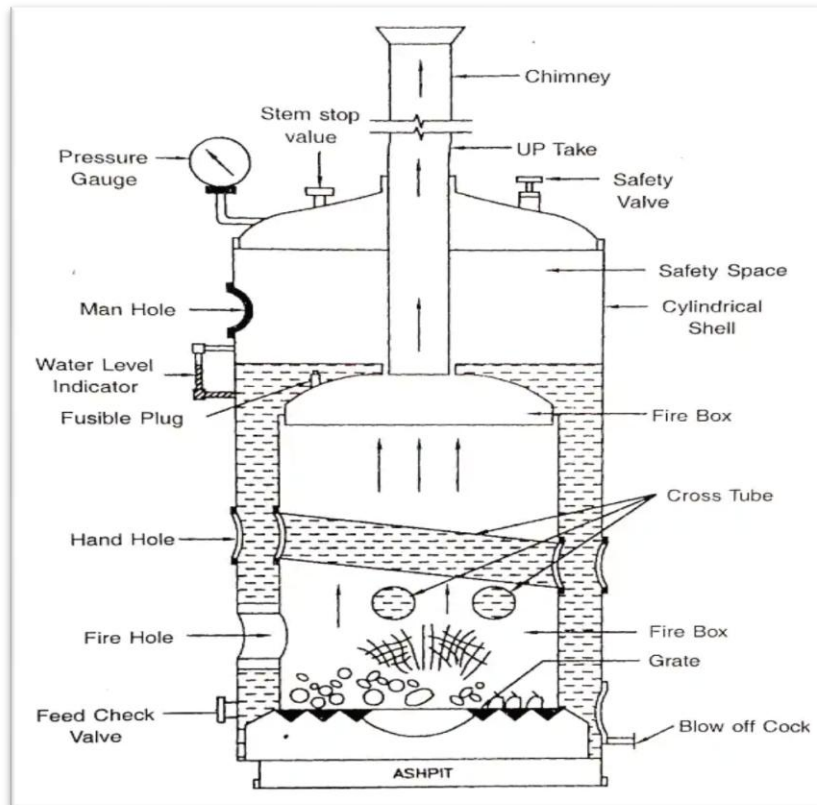


2. **Decorticator Machine:** - This machine serves the purpose of bifurcating the groundnut pods by using shear force of action into kernels and outer shell.

2. Cross Tube Boiler:
to the cross drum
lowers down by the
into the inclined water
The steam is generated
chamber.



-The feed water is supplied through inlet, this water then downcomer pipe and enters tube placed in hot chamber. and is fed into the steam



3. Oil Expeller: -It is used in crushing the peanut kernels to extract oil. The expelling unit comprises of a screw expellant shaft. Rotary screw movement is made by the shaft to crush the kernels. Subsequent heating of groundnut seeds is achieved by the generated heat that heats the surrounding of the seeds passage.



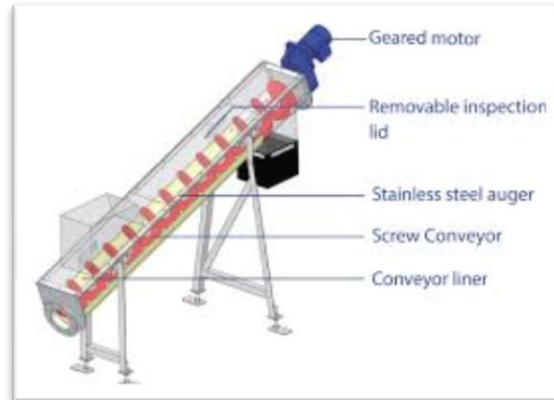
- 4. Oil Filter Press:-** To separate the residual cake from oil, an industrial filter is put to application. A bunch of filter elements are stacked in such a way that it can be easily opened and the filtered solids can be removed. It facilitates the cleaning process and replacement of filter elements.



- 5. Bottle filling Machine: -** The machine fills the bottles with oil at controlled pressure and in required quantity.



6. Screw Conveyor: - It is used for conveying the raw material to different machines in processing section. By-products or oil cakes are also conveyed to collection units.



7. Collection tanks/ Silos: - It is used for storage of various products right from the raw material to the intermediary products and the by-products or finished goods during the whole process.



2.5 Peanut butter



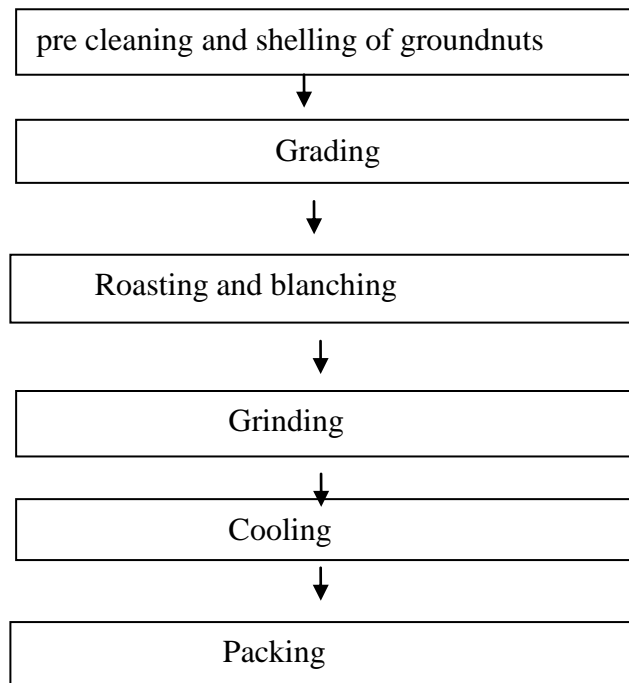
Peanuts have substantial nutrients and are eaten all over the world in various ways, too long. One such commodity is peanut butter, which is consumed in large amounts, especially in Western nations for many years. In India, it is not very popular and the domestic market is occupied by butter from milk. The promoters must also target the rising manufacturing and export markets.

Processing steps

Clean the high-quality peanut kernel and roast it to a mild degree before a nice fragrance emerges. By moving the roasted kernel through a blanching system, red skin is eliminated. By sieving, the germs are isolated, and by hand sorting, the spoiled kernels are eliminated. The kernels are ground for medium grinding in a grinding unit. At the 5% mark, hydrogenated fat containing Vit-A is applied as this helps to avoid oil separation. At the 2 percent mark, sodium chloride is added. (Atli Arnarson, 2019)



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Flowchart 5: flowchart of the processing of peanut butter

- Pre-cleaning and shelling
- Peanut grading
- Peanut roasting and blanching
- Roasting (1600 °C) for 40 – 60 minutes depending upon the moisture content . Moisture is further reduced to about 1% , improves flavor and shelf life . Roasting is followed by cooling and blanching.
- Grinding
- Creamy and fine butter is made after grinding, it is milling into two stages. The outlet temperature reaches about 65 – 75 °C. While grinding ingredients like salt, sugar and stabilizers are added .
- De-aeration – vaccum de-aeration method is followed
- Cooling - the cooling is done usually by a scraped surface heat exchanger . the stabilizer used determine the outlet temperature .
- Filling and packing - metal drums / pet jar are used for packaging . Filling is followed by immediate vibration to remove trapped air.At 20 °C the jars are places for 35 – 40 hours , for settling then it is further dispacked . (Atli Arnarson, 2019)

2.5.1 Packaging

Packed in flexible pouches, plastic and glass jars.

2.5.2 Shelf life

peanut butter in the pantry for 6-9 months (unopened) and 2-3 months (opened).

2.5.3 Machineries Required



Peanut Roasting Machine



Peanut Butter Grinder



Food Paste Filling Machine



Jar Capping Machine

2.6 Salted groundnuts

Salted groundnuts are very popular in Western India and prepared by soaking the groundnut kernels (HPS) in water with 4 percent common salt (NaCl) solution for 12 hours .Soaked kernels are dried and roasted with sand. If the skin is peeled off and the roasted kernels are packed in attractive packs(plastic laminates) it may add to their value.



2.7 Quality attributes of Groundnut Products

Flavour

The acceptability of the groundnut product like the peanut butter is mostly contributed by flavor. Also the volatile compounds present in the groundnut oil and wasted ground nut plays the important role as the precursors in the production of specific flavor. The gas chromatography sensory analysis, etc can be performed to evaluate the flavor of nuts and its products (Ahmed and Young, 1982)

Texture

The most preferred crunchy and crispy texture for the groundnut development institute which can evaluate mechanical properties of nuts had helped to understand the texture of the nuts

Sensory quality

The sensory physical property similarities and difference can be found by biting or chewing the kernels separate analysis for raw, blanched and oil roasted groundnuts need to be understood.

Colour the testa and oil contributes colour of raw kernels. Tannins catechol and B carotenes and lutein imparts colour to tests and oil separately less dark colored oil is likely to be preferred by users caramelisation in roasted groundnut may lead to discolorisation

Indian groundnut with its special natural aroma flavour taste and unique crunchy texture is very popular in the market the quality of groundnut based products depends upon the quality of the roasted groundnut

2.8 Market Potential of Groundnut Products

With big exports every year, Indian peanuts are common all over the world. Unfortunately, Our market share is limited mainly to raw peanuts and value-added goods. There is a rather negligible contribution from blanched & roasted peanuts or peanut butter. In the world peanut butter has yet to be picked up and the project must focus on foreign purchasers. In the USA, UK, Holland, Australia, New Zealand, peanut butter is very popular, South Africa and the nations of Southeast Asia and the Gulf. Both of these are very wide and increasing. There's got to be Very strict control over quality. Approximately 80% of revenue would be by exports and promoters. You will want to register as an export-oriented unit (EOU) Nevertheless, although India is the world's largest producer of peanuts, peanut butter production is It isn't an effective operation. There may be one or two peanut processing (Medium-scale) butter units in India. There are still no large-scale units built in the region.

Hurdles: 1) peanut butter is not a mass-based food approved in India due to its Nutty flavor and 2) Immense expenditure in resources needed to set up the machine. However, in light of this, It is now the best time to set up such eating units to liberalize India's industrial policy.

A lucrative income from exports. In order to raise health understanding of low calorie and high protein ingredients, In the coming decade, the intake and use of peanut butter is bound to increase.

(Atli Arnarson, 2019)

CHAPTER- 3

PACKAGING

3.1 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.

Packaging requirements for Edible oil/ fat: Tin Plate used for the manufacture of tin containers for packaging edible oils and fats shall conform to the standards of prime grade quality contained in B.I.S. Standards No. 1993 or 13955 or 9025 or 13954 as amended from time to time and in respect of Tin containers for packaging edible oils and fats shall conform to IS No. 10325 or 10339 as amended from time to time.

3.2 Labeling regulations

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.

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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.

7) License number shall be displayed on the principal display panel in the following format,

Labeling of pre-packaged foods

I. 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

d) where an ingredient itself is the product of two or more ingredients, such a compound ingredients shall be declared in the list of ingredients, and shall be accompanied by a list, in brackets, of its ingredients in descending order of weight or volume.

(e) Added water shall be declared in the list of ingredients except in cases where water forms part of an ingredient, such as, brine, syrup or broth, used in the compound food and so declared in the list of ingredients: Provided that water or other volatile ingredients evaporated in the course of manufacture need not be declared

(f) Every package of food sold as a mixture or combination shall disclose the percentage of the ingredient used at the time of the manufacture of the food (including compound ingredients or categories of ingredients), if such ingredient– (i) is emphasised as present on the label through words or pictures or graphics; or (ii) is not within the name of the food but, is essential to characterise the food and is expected to be present in the food by consumers, if the omission of the quantitative ingredient declaration will mislead or deceive the consumer.

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3. Nutritional information – Nutritional Information or nutritional facts per 100 gm or 100ml or per serving of the product shall be given on the label containing the following:—

(i) energy value in kcal; (ii) the amounts of protein, carbohydrate (specify quantity of sugar) and fat in gram (g) ; (iii) the amount of any other nutrient for which a nutrition or health claim is made.

4. Declaration regarding Veg or Non veg – symbols of vegetarian and non vegetarian should be given as per prescribed format by fssai.

5. Declaration of Food Additives:

(i) 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

(ii) Addition of colours and/or Flavours-

(a) Extraneous addition of colouring matter to be mentioned on the label

(b) Extraneous addition of flavouring agents to be mentioned on the label

(c) In case both colour and flavour are used in the product, one of the following combined statements in capital letters shall be displayed, just beneath the list of ingredients on the label attached to any package of food so coloured and flavoured

(6) Name and complete address of the manufacturer

(7) Net content

(8) Lot/Code/Batch identification

(9) Date of manufacture or packing.-

(10) Best Before and use by date

(11) Country of origin for imported food

(12) Instructions for use

LABELLING OF EDIBLE OILS AND FATS

1. The package, label or the advertisement of edible oils and fats shall not use the expressions “Super-Refined”, “Extra-Refined”, “Micro-Refined”, “Double-Refined”, “Ultra-Refined”, “AntiCholesterol”, “Cholesterol Fighter”, “Soothing to Heart”, “Cholesterol Friendly”, “Saturated Fat Free” or such other expressions which are an exaggeration of the quality of the Product.

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2. Every container in which solvent-extracted oil or de-oiled meal or edible flour is packed for sale shall, at the time of sale by the producer, bear the following particulars in English or Hindi (Devnagri script) :-

(i) the name, trade name, if any, or description of the solvent-extracted oil or de-oiled meal or edible flour, as the case may be:

(ii) in the case of oil not conforming to the standards of quality for “refined” grade solvent extracted oils specified in regulation 2.2.6 (1) of Food Safety and Standards (Food Products Standards and Food Additive) Regulation, 2011 for Edible vegetable oil/Vanaspati, a declaration in a type-size of not less than 50 mm, as follows shall appear on the label:

(a) “NOT FOR DIRECT EDIBLE CONSUMPTION”, in the case of oils complying with the requirements for the “semi-refined” or “raw-grade 1” grades of oil specified in regulation 2.2.6 (1) of Food Safety and Standards(Food Products standards and Food Additive) Regulation, 2011

(b) “FOR INDUSTRIAL NON-EDIBLE USES ONLY”, in the case of oils not complying with the requirements under item (a) above; (iii) the name and business particulars of the producer;

(iv) the net weight of the contents in the container; (v) the batch number, month and year of manufacture: Provided that where solvent extracted oils are transported in bulk in rail tank-wagons or road tankers, or where de-oiled meal or edible flour is transported in bulk either for storage in silos or transferred to ship for bulk shipment, it shall be sufficient if the aforesaid particulars are furnished in the accompanying documents.

3. Every container in which solvent is packed shall, at the time of sale by the manufacturer or dealer thereof, bear the Indian Standards Institution certification mark.

4. Every container in which vanaspati, margarine, bakery shortening, blended edible vegetable oils, mixed fat spread and refined vegetable oil is packed in addition to other labelling requirements provided in these regulations shall bear the following particulars in English or Hindi in Devnagri script:

(a) The name/description of the contents, “free from Argemone Oil”;

(b) The mass/volume of the contents;

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5. Every package containing an admixture of edible oils shall carry the following label declaration immediately below its brand name/trade name on front of pack, namely:-

Blended Edible Vegetable Oil
(Name and nature* of edible vegetable oil)% by weight
(Name and nature* of edible vegetable oil)% by weight

(*i.e. in raw or refined form)

The font size of the label declaration “Blended Edible Vegetable Oil” shall not be less than 5 mm and for label declaration “Name and nature of edible vegetable oil.....% by weight”, font size shall not be less than 3mm:

Provided that the font size of the label declaration “Blended Edible Vegetable Oil” shall not be less than 10mm in case the net quantity of the edible oil contained in the packages is 5 litre and above.

CHAPTER- 4**FOOD SAFETY AND FSSAI STANDARDS****4.1 FSSAI Standards for Oil**

Groundnut oil (moongh-phali-ka tel) means the oil expressed from clean and sound groundnuts .It shall be clear, free from rancidity, suspended or other foreign matter, separated water added colouring or flavoring substances or mineral oil. It shall conform to the following standards:-

Moisture	Not more than 0.1 % by weight
Refractive index	1.4630- 1.4670
Butyro refractive reading at 40°C	55.6-61.7
Saponification value	189-195
Iodine value	95-110
Acid value	Not more than 0.50
Un saponification matter	Not more than 1.5% by weight
Linolenic acid	Not more than 3 % by weight
Flash point	Not less than 250 °C
Cloud point	Not less than 25°C
Test for the argemone oil shall be negative	

Table 5: quality standards of groundnut oil

Test for argemone oil shall be negative. However, it may contain food additives permitted. Further, if the oil is obtained by the method of solvent extraction and the oil imported into India whether obtained by solvent extraction or otherwise, it shall be supplied for human consumption only after refining and shall conform to the standards laid down under The oil so refined shall not contain Hexane more than 5.0 ppm.

4.2 FSSAI standards for Peanut butter

Parameter	Limits
Moisture	Not more than 3 % by weight
Fat	Not less than 40 % by weight (on dry basis)
protien	Not less than 25% by weight (on dry basis)
Total ash	Not less than 5 % by weight (on dry basis)
Acid value of extracted fat	Not more than 4
Salt as Nacl	Not more than 2 % by weight (on dry basis)

Table 6: quality standards of peanut butter

Peanut Butter means cohesive, comminuted food product prepared from clean, sound, shelled peanuts or groundnuts (*Arachis hypogaea L.*) by grinding roasted mature kernels from which the seed coats have been removed. It may contain sugar, liquid glucose and edible oils and fats .

4.3 FSSAI Regulations

1. Refined vegetable oil means any vegetable oil which is obtained by expression or solvent extraction of vegetable oil bearing materials, deacidified with alkali and/or physical refining and/or by miscella refining using permitted food grade solvents followed by bleaching with absorbent earth and/or carbon and deodorized with steam. No other chemical agent shall be used. The name of the vegetable oil from which the refined oil has been manufactured shall be clearly specified on the label of the container. In addition to the under mentioned standards to which refined vegetable oils shall conform to the standards prescribed in these regulations for the specified edible oils shall also apply except for acid value which shall be not more than 0.5. Moisture shall not exceed 0.10 per cent by weight. Test for argemone oil shall be negative.

2. The refined vegetable oil shall comply with the following requirements: The oils shall be clear and free from rancidity, adulterants, sediments, suspended and other foreign matter, separated water, added colouring and flavouring substances and flavouring substances and mineral oil.

4.4 Food Safety Guidelines

Good Manufacturing Practices for whole premises

I. Food preparation areas

The following rules apply to rooms where food is prepared. There will be no smoke nuisance in the food preparation area. Wherever cooking or frying of any kind is being done, a chimney having appropriate suction capacity as per the size of the kitchen has to be installed prior to start of business.

II . Hand washing facilities and toilets

1. Adequate number of wash-hand basins made of porcelain/stainless steel shall be provided along with soap to wash hands, with hot and cold running water, and materials for cleaning hands and drying them hygienically. Clean and dry towels shall be kept for the use of customers.

2. Separate sinks must be provided, where necessary, for washing raw food and cleaning equipment.

3. Sinks with a draining board, detergent and hot water shall be provided to ensure proper cleaning of utensils, crockery and cutlery there will be a separate place for washing pots and pans.

4. There must also be enough toilets and those must not lead directly into food areas. 5. There shall be separate Sinks for washing utensils and raw food items 2. Changing facilities: Facilities for staff to change their clothes, where necessary must be provided.

Good Hygienic Practices

Personal hygiene

1. High standards of personal hygiene should be maintained.

2. All employees handling food should wash their hands properly:

- before preparing food
- after touching raw food or materials, specially meat/poultry or eggs
- after breaks
- after using the toilet
- after cleaning the raw materials or utensils / equipments

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3. Staff working with food must wear suitable clean clothes and where necessary, shall wear head cover, apron, musk mouth and use gloves etc.
4. Street shoes inside the food preparation area should not be worn while handling & preparing food.
5. Food handlers should ensure careful food handling & protect food from environmental exposure.
6. Food handlers should avoid following practices while handling food
 - Chewing or smoking tobacco
 - Chewing betel nut or gums
 - Touching mouth, tongue, nose, eyes or other body parts
 - Spitting, sneezing, coughing, etc.
 - Touching ready-to-eat food with bare hands
 - Handling food and money at same time
 - not to wear watches or jewellery while preparing food
7. All food handlers should be medically fit and free from diseases.

CHAPTER - 5

OPPORTUNITIES FOR MICRO/UNORGANIZED ENTERPRISES

5.1 PM-FME Scheme:

Ministry of Food Processing Industries (MoFPI), in partnership with the States, has launched an all India centrally sponsored "PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)" for providing financial, technical and business support for up-gradation of existing micro food processing enterprises. The objectives of the scheme are :

- I. Support for capital investment for up-gradation and formalization with registration for GST, FSSAI hygiene standards and UdyogAadhar;
- II. Capacity building through skill training, imparting technical knowledge on food safety, standards & hygiene and quality improvement;
- III. Hand holding support for preparation of DPR, availing bank loan and up-gradation;
- IV. Support to Farmer Producer Organizations (FPOs), Self Help Groups (SHGs), producers cooperatives for capital investment, common infrastructure and support branding and marketing.

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