Ministry of Food Processing Industries
Government of India

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Reading Manual for Soya Soy Paneer

Under PMFME Scheme

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ABBREVIATIONS & ACRONYMS

Sr: No.	Abbreviations &Acronyms	Full Forms
1.	DHA	Docosahexaenoic acid
2.	FAO	Food and Agriculture Organization
3.	FBO	Food Business Operator
4.	FLRS	Food Licensing and Registration System
5.	FPOs	Farmer Producer Organizations
6.	FSSAI	Food Safety and Standards Authority of India
7.	GMP	Good manufacturing practice
8.	kcal	kilocalorie
9.	MoFPI	Ministry of Food Processing Industries
10.	PA	Polyamide
11.	PET	Polyesters
12.	PFA	Prevention of Food Adulteration
13.	RF	Refined Wheat Meal
14.	SHGs	Self Help Groups
15.	UAE	United Arab Emirates
16.	UK	United Kingdom
17.	US	United States
18.	WGWF	whole-grain wheat flour
19.	WVTR	water vapor transmission rate

CHAPTER 1
INTRODUCTION

1.1. Industrial Overview:

Soybean or *Glycine max L*. is a legume plant that Originated in Eastern Asia that has many uses and is widely cultivated for edible beans. Soybeans contain large quantities of phytic acid, nutritional minerals, and vitamins B. Another commodity in the processing of soybean crops is soy vegetable oil used in the food and industrial applications.

Soybean is the world's leading seed legume, contributing to 25% of the global edible oil and about 2/3 of the World's animal feed protein concentrate. Soybean is an important ingredient of feeds for poultry and fish food. Soybeans are a world-wide grown crop that provides oil and protein. Nuggets of soya beans are generally referred to as vegetarian meat for its similar characteristics to original meat. Soya bean is a rich protein source and is the highest protein (approx. 50 %) of all vegetarian foods. Soya beans are mostly grown in Madhya Pradesh though also cultivated in states such as Chhattisgarh, Gujarat, and West Bengal is a large area.

Soybeans are the dairy substitutes (e.g. soy milk, soy Soy Paneer, margarine, soy ice cream, soy yogurt, soy and soy cream cheese) and meat alternatives, (e.g. veggie burgers). These substitutes are readily available in most supermarkets and markets. Soya chunks or chunks are made of soy flour, which is a by-product of soy oil extraction. It has the same protein content as meat. It can be cooked quickly and easily. it can be used to cook a lot of dishes, such as soya pulao, soups, stir-fries, and more.

India's soya milk industry is valued at Rs. 50 crore and has a 50 per cent CAGR. Madhya Pradesh, Maharashtra and Rajasthan account for the large share of soybean production in India. Therefore, most soya processing units are located in these states. Nearly 85% of the soybeans produced in the country are estimated to be processed to obtain value-added goods

and nearly 20% are processed in Rajasthan alone. Hence, in Rajasthan, soybean processing is an important field. More than 60 soybean processing units are estimated in Rajasthan, but most of them are engaged in processing oil, de-oiled cake and lecithin soybeans. Just a handful are involved in the manufacture of value-added goods, reflecting concerns about the feasibility of investments in value-added soybean products. With the growing consciousness of people about the added value of soybean products, demand for the products is also increasing.

Soy milk and Properties with Derivatives:

- Soymilk
- Tofu
- Yogurt Soy
- Okara

1.2. Product Description:

Soya Milk's place of origin is China, which was invented before 1365. The usual word is "Dou Jiang," which is used for the traditional bean and watery beverage developed as a natural secondary bean curd or tofu manufacturing commodity. Later, in the 20th century, it became a popular drink in the following countries: North America and Europe. The place of origin of Soya Soyabean is the healthiest and cheapest produce. Soya milk and associated products, thanks to their outstanding nutritional values and medicinal properties, food items are becoming popular across the world. Soy milk is rich in calcium, low in carbohydrates and fats, and does not produce cholesterol. As it contains vegetable protein that is very nutritious and easy to digest, it is an excellent food for infants, children, elderly people and pregnant and lactating mothers. In addition to having elevated nutritional values, soy milk is suitable for people with diabetes and lactose intolerance. It can be said that the Soyabean is a precious offering to human beings from mother nature.

In China, Tofu emerged. It is believed that Liu An, a prince of the Han Dynasty who lived during the second century B.C., first invented it. The Japanese Food Research Institute

advocated modernizing and standardizing the production of tofu in Japan during the 1960s. This initiative has contributed to important developments in the manufacturing of tofu. While tofu has been produced since the beginning of the 20th century in the United States, its consumption did not grow steadily until about 1970.

Soya Soy Paneer/Tofu is a milk Soy Paneer that is similar to normal. Soya Soy Paneer is also known as "Bean Curd, Soya Milk Soy Paneer or Tofu," a soft cheese prepared with a liquid by curding soy milk. The change in market attention from animal products is partly due to the growing concern of people about animal rights, personal health, and, most significantly, sustainability. High levels of cholesterol, salt, and calories are linked with the ingestion of animal protein, raising the risk of heart disease, high blood sugar, and obesity; hence, people show an attraction towards the vegan source of protein. This has provided a strong forum for development in the tofu industry. In addition, young people are searching for an alternative to red meat, but at the same time they are not prepared to give up protein, so they are transitioning globally to plant-based protein goods, such as tofu, which are improving the tofu market.

1.3. Market Potential:

During the forecast period, the global tofu market is expected to expand at a CAGR of 5.1 percent. The demand is driven by a rising desire for plant-based goods and a shift towards a vegan diet among customers. The rich nutritional profile of tofu is also fueling global consumer demand. The scarcity of alternative goods and the high rate of perishability of tofu and tofu-based products are the key problems facing the industry.

Companies, such as House Food Company, offer a wide variety of tofu items to attract buyers, such as premium tofu, DHA omega-3 enriched tofu, vacuum bag, cutlet tofu, etc. In terms of sales, Asia Pacific led the global tofu market while the United Kingdom primarily leads the development of the market, due to changing dietary trends to veganism, led by the U.S. China, Japan, South Korea, Vietnam, the Philippines, Thailand, and Indonesia are the main contributor countries in the Asia-Pacific region. China is one of the fastest growing soybean markets and is also projected to be an important exporter. This will eventually impact the rising demand for goods focused on tofu and tofu. Because of its high nutritional advantages, the developing nations of the Middle East and Africa also have tremendous prospects for the global tofu market. For example, tofu is currently used as a meat replacement in shawarma, a fast food staple in the Middle East, which boosts the demand for tofu.

In 2018, the global tofu market size was projected at USD 2.31 billion and is anticipated to grow from 2019 to 2025 at a CAGR of 5.2 percent. The growing preference for vegan diets in developing countries, including the United States and Germany, is projected to remain a major driving force due to an increasing number of initiatives aimed at eliminating animal slaughter. Tofu is known to be nutritious and gluten-free. 8% protein and 2% carbohydrates along with other nutrients are in one 3.5 ounce serving of this drink. The U.S. Food and Drug Administration (FDA) advises that 25 grams of soy protein be taken everyday to ensure adequate protein consumption along with healthy amounts of cholesterol.[i]

1.4. Raw Material Description:

In the main food groups of protein, sugar, and carbohydrates, as well as vitamins and minerals, soybeans are perfectly healthy. Soybeans also provide the optimal number and mixture of amino acids required for the human body's assimilation of nutrients.

Glycine max is the scientific name for the soybean and it is part of the Leguminosae botanical family. The soya plant has a somewhat woody stalk and is 30-36 inches long (76-91 cm). The whole plant is coated with fur that is greenish. If the beans age, the leaves grow in groups of three and fall off. Papilionaceous (butterfly-shaped) flowers that are either white, red, or purple are produced by the soya plant. The pods grow in length from 1-2 inches (2.5-5 cm), each containing two or three seeds that develop into soybeans. The seeds of Soya are either circular or oval and are peas-like in size. Usually, their color is yellow, but they may also be gray, purple, orange, or a combination of colors. Soybeans are pulses, i.e. the plant has a symbiotic relationship with the bacteria called rhizobia, which in the roots of the soya plant emit nitrogen by nodules. Although it is actually a sub-tropical plant, the soya plant can grow as far north as 52 degrees latitude. For growing soybeans, each environment needs minor alterations, but in general, beans are sown with heavy machinery in the middle of May. The soya leaves slip off as the beans ripen. Just the stalks and pods remain after the brief growth cycle of 15 weeks. The plants are manually collected.

1.5. Types of Raw Material:

In both Western and Eastern markets, a wide range of tofu styles and flavors are available. Tofu products can be categorized into two major groups, considering the variety of options:' fresh tofu' that is made directly from soy milk, and 'processed tofu' that is produced from fresh tofu. The processing of tofu often produces substantial by-products that are found in different cuisines.

Unpressed- Unpressed new tofu is soy-milk gelled with curd that has not been cut from its liquid and pressed. Various types of unpressed tofu are made, depending on whether the soy milk is gelled with nigari (magnesium chloride) solution or gypsum (calcium sulphate) suspension. Gypsum-gelled soft tofu is commonly known as soft tofu, silken-tofu, or douhua, and has a smooth and gel-like appearance. The spongy-curdled texture of the nigari-gelled variety is very smooth and is known as extra-soft or sun-dubu. Unpressed tofu is so delicate that the gelling jar is directly ladled out to be served or sold.

- Extra soft

In Korean, unpressed bittern-gelled soft tofu is referred to as sun-dubu ("mild tofu"). In order to curdle, soy milk is mixed with seawater, or salty water made with sea salt. The curds stay smooth and loose. With little to no seasoning, freshly made sun-dubu is eaten boiled. Usually, manufactured sundubu is sold in tubes. It is the main ingredient in sundubu-jjigaee as well ("soft tofu stew").

- Soft

This tofu, which has a high moisture content, is undrained, unpressed. By coagulating soy milk without cutting the curd, silken tofu is made. Silken tofu is available in various consistencies, including soft and hard, but all silken tofu is more delicate and has distinct culinary applications than standard firm tofu (pressed tofu). This tofu, which has a high moisture content, is undrained, unpressed. By coagulating soy milk without cutting the curd, silken tofu is made. Silken tofu is available in various consistencies, including soft and hard, but all silken tofu is more delicate and has distinct culinary applications than standard firm tofu (pressed tofu). Silken tofu, especially for smoothies and baked desserts, is used as a replacement for dairy products and eggs.

Pressed Fresh- Two types of tofu are made based on the amount of water removed from the cut and pressed curds: firm and extra-firm. To preserve its moisture content and freshness, and to slow bacterial growth, fresh tofu is commonly sold fully submerged in water.

- Firm

Firm tofu (called lǎodòufu in Chinese; momen-dōfu in Japanese, cotton tofu; mo-dubu in Korean): This type of fresh tofu, while drained and pressed, retains a high moisture content. It has the firmness of raw meat and, when pressed, bounces back readily. The texture of the tofu inside is identical to the texture of a strong custard. The skin of this type of tofu retains the muslin pattern used to drain it and the outside is slightly more resistant than the inside to damage. It can conveniently be picked up using chopsticks.

- Extra-Firm

Dòugān (Chinese, simply "dry tofu") or su ji (vegetarian chicken) is an extra firm tofu type where a significant proportion of the liquid has been squeezed out. Of all fresh tofu, Dòugān has the least amount of moisture and has the firmness of thoroughly cooked meat and a slightly rubbery texture similar to that of Soy Paneer. It is easy to crumble this tofu when thinly cut. The design of the muslin used to drain and press it has the skin of this type of tofu. After pressing, western firm tofu is milled and reformed.

A more prevalent type of unflavored, extra-firm tofu is Su ji. It is not possible to crumble and has a more rubbery feel.

Processed Tofu- Several varieties of refined tofu exist. Some processing strategies presumably derive from the need to conserve tofu, or to improve its shelf life, before the days of refrigeration. In order to produce tofus of various textures and flavors, other development processes are used.

- Fermented
  - *Pickled tofu*, also known as "preserved tofu" or "fermented tofu" (in Chinese, pinyin: dòufur, or chao in Vietnamese), consists of dried tofu cubes that have been allowed to dry completely under hay and ferment slowly with the help of aerial bacteria. Afterwards, the dried fermented tofu is soaked in salt water, Chinese rice wine, vinegar or minced chilies, or a combination of whole rice, soybeans and bean paste.
  - *Stinky tofu* is a soft tofu fermented in a vegetable and fish brine (in Chinese, Pinyin: chòudòufu). There is a pungent cheese scent on the blocks of tofu, often resembling rotten fruit. The taste and texture of stinky tofu is enjoyed by aficionados, who describe it as delightful, considering its heavy scent.
- Frozen
  - *Thousand-layer tofu* (both means "frozen tofu" in Chinese) is frozen tofu. Inside it, the ice crystals that grow result in the creation of large cavities that seem to be layered. In the freezing process, frozen tofu takes on a yellowish color. Thousand-layer tofu originates from China's Jiangnan area and is usually made from soft tofu at home. The texture and taste depends on the broth or cooking stock in which it has been simmered.
  - *Koya-dofu* was found by mistake when tofu was left outside in the winter season. In Japanese markets, it is sold in freeze-dried blocks or cubes. In dashi, sake or mirin and soy sauce, it is usually simmered. Vegetarian kombu dashi, made out of seaweed, is

used in shōjin ryōri. It has a spongy feel and a slightly sweet or savory taste when cooked in the normal way. The texture and taste depends on the broth or cooking stock in which it has been simmered.

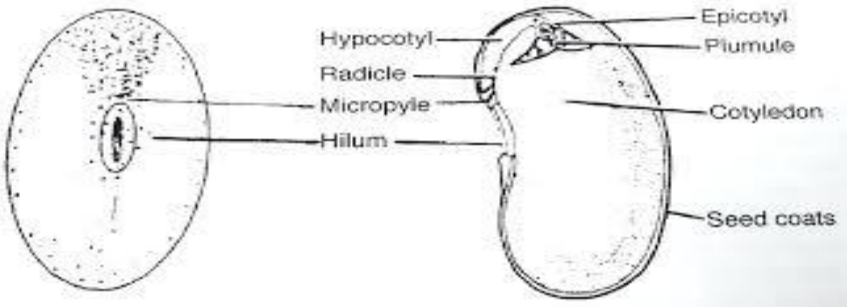
- *Shimidofu* is eaten mostly in the region of Tohoku. If shade-drying produces Koya-dofu, sun-drying produces shimidofu.

CHAPTER 2
PROCESS & MACHINERY REQUIREMENT

2.1. Raw Material Aspects:

With soybean seeds losing moisture, it shifts from large to smaller, almost round kidney bean-shaped. The seed contains around 40% protein, 21% fat, 34% carbohydrates, and 5% ash when dry. The soya bean (Glycine max) is a legume species native to East Asia, commonly cultivated for its edible bean, which is used for many different applications.

Traditional unfermented food uses of soybeans include soy milk, from which tofu and tofu skin are made. Soya sauce, bean paste, nattō, and tempeh are all fermented foods. Fat-free (defatted) soy meal is a substantial and cheap protein source for animal feed and a wide range of packed foods. For example, in many forms of meat and milk supplements, soya products, such as textured vegetable protein (TVPs), are ingredients.



2.2. Source of Raw Material

Maharashtra and Madhya Pradesh dominate soybean production in India, contributing 89 percent of the total production. The remaining 11 percent of production contribute by Rajasthan, Andhra Pradesh, Karnataka, Chhattisgarh, and Gujarat. According to the expected production of soybeans India is given in the following table:

2020 SOYBEAN PRODUCTION BY STATE				
S. No.	**States**	**Kharif 2020**		
		Sowing Area	Expected Yield	Estimated Production
1	Rajasthan	11.002	780	8.585
2	Madhya Pradesh	58.541	714	41.774

3	Maharashtra	40.398	1125	45.446
4	Andhra Pradesh	1.599	1028	1.644
5	Chhattisgarh	0.776	884	0.686
6	Gujarat	1.492	972	1.45
7	Karnataka	3.32	1124	3.732
8	Others	1.257	988	1.242
	Grand Total	**118.385**	**883**	**104.559**[ii]

The whole soybeans can be procured and processed to obtain soya milk and its product or various online platform provide soya seed for the further processing.

2.3. Technologies:

Traditional methods

In a larger iron pot, soy milk is heated. The coagulant (citric acid) is added to hot milk and mixed with a ladle till the coagulation is over.

To wash off the whey, the contents of the vessel are poured over a piece of coarse cloth. Until all the milk is coagulated, the whole process is repeated. After draining the whey, the coagulated mass is gathered and pressed to extract more whey. Finally, in chilled water, the product is then dipped.

A modern method

The required fate and protein ratio is standardized for Soya Milk. Milk is heated in jacketed vessels to 90 ° C without holding it and cooled down to 70 ° C. By slowly adding 1 to 1.5 percent citric acid solution (70 ° C) with continuous stirring until a clean whey is separated at (pH 5.30 to 5.35) and coagulum is allowed to settle for 5 min and drained from the whey, coagulation is performed at around 70 ° C. The coagulated mass thus obtained is filled into a muslin or cheesecloth-lined hoops. The pressure is applied at a rate of 0.5 to 1kg/cm2 on top of the hoop. For 2-3 hours, the pressed paneer blocks are separated from the hoops and immersed in chilled water. Then the chilled paneer is removed from the water for drainage. Finally, paneer blocks are wrapped in bags of parchment paper/polyethylene and placed at around 5 to 10°C in a cold space.

2.4. Manufacturing Process:

The following steps are involved in soya paneer making process:

- Raw material is procured from the local vendor
- All raw materials are placed in the inventory
- Dry beans are soaked in water for a minimum of 3 hours
- Rehydrated beans then undergo wet grinding with added water
- The ratio of water to beans on a weight basis is 10:1
- Soy Milk is extracted from ground pulp or puree.
- Soy Milk is cooked to improve taste by inactivating trypsin inhibitor
- The other major role of cooking is to inhibit microbial growth
- Soy Milk is then cooled to required temperature for coagulation
- Coagulation is most important step in tofu manufacturing
- Different coagulants are used to produce different types of tofu
- Commonly used coagulants types are salts, acids, and enzymes
- Coagulants are added in concentrations between 1.5 & 5.0 g/kg
- Coagulants are added at temperatures between 60°C & 90°C
- Coagulated mass is then extracted from coagulation tank
- This coagulated mass is pressed to obtain soy paneer
- These tofu are then cut in appropriate sizes, packed & dispatched

2.5. Flow Chart:

Steps	Machine Name	Description	Machine Image.
Washing and Soaking of soybeans	Soybean Soaking & Washing Machine	It's a washer class machine, used to wash soybean. Some machine performs soaking, sorting & washing together.	

Grinding	Grinding & Separating Machine	It's a grinder class machine, used to grind soybean It simultaneously extracts soy milk by separating Okara.	
Soymilk Cooking Machine	Soymilk Cooking Machine	It's a cooking vessel class machine designed to cook soy milk. They can be used for other similar products.	
Coagulation and mould filling	Coagulation Tank with Mould Filling Machine	Contains coagulation tank, filtration array & mould filling machine This machine is specifically used for Paneer & Cheese.	
Pressing	Paneer & Cheese Press	It's a press type machine used for Cheese & Paneer production It's used to press coagulated mass into required shape.	
Packaging	**Vacuum packaging machine**	This machine is used for packaging the paneer in appropriate size.	

2.6. Additional Machine & Equipment:

Machine and Equipment	Uses	Pictures
Boiler	It's steam generating device which simply produce steam It utilizes heat generated by burning appropriate fuel.	
Belt Conveyor	used in transportation of bulk materials	
Material handling Equipments	The material required for handling during processing process.	

2.7. General Failures & Remedies:

S. No.	General Failures	Remedies
1.	Ball bearing failure of various machine	➢ Proper periodic lubrication of all bearings in various machines. ➢ Regular replacement of all bearing to prevent critical failures.
2.	Power Drive Overload	➢ Ensure proper weighing & metering specially in case of semi-automatic plant. ➢ Install warning sensor in buffer region of loading capacity to ensure efficient operation.
3.	Mechanical Key Failure	➢ Ensure that mechanical keys are replaced as per there pre-defined operational life. ➢ Prevent Overloading.
4.	Loss of Interface	➢ This problem is dominant in newly

		established automatic plant, one must learn to maintain rules in plant & ensure no employee goes near transmission lines, unless authorised. ➢ Provide proper physical shielding for the connections.

2.8 Nutritional Content of Mature Soy Seed per 100g:

S. No	Nutrients	Quantity
1.	Carbohydrates	30.16 g
2.	Sugars	7.33 g
3.	Dietary fiber	9.3 g
4.	Fat	19.94 g
5.	Saturated	2.884 g
6.	Monounsaturated	4.404 g
7.	Polyunsaturated	11.255 g
8.	omega-3	1.330 g
9.	omega-6	9.925 g
10.	Protein	36.49 g
11.	Tryptophan	0.591 g
12.	Threonine	1.766 g
13.	Isoleucine	1.971 g
14.	Leucine	3.309 g
15.	Lysine	2.706 g
16.	Methionine	0.547 g
17.	Cystine	0.655 g
18.	Phenylalanine	2.122 g
19.	Tyrosine	1.539 g
20.	Valine	2.029 g

21.	Arginine	3.153 g
22.	Histidine	1.097 g
23.	Alanine	1.915 g
24.	Aspartic acid	5.112 g
25.	Glutamic acid	7.874 g
26.	Glycine	1.880 g
27.	Proline	2.379 g
28.	Serine	2.357 g
29.	Vitamin A equiv.	1 µg
30.	Thiamine (B1)	0.874 mg
31.	Riboflavin (B2)	0.87 mg
32.	Niacin (B3)	1.623 mg
33.	Pantothenic acid (B5)	0.793 mg
34.	Vitamin B6	0.377 mg
35.	Folate (B9)	375 µg
36.	Choline	115.9 mg
37.	Vitamin C	6.0 mg
38.	Vitamin E	0.85 mg
39.	Vitamin K	47 µg
40.	Calcium	277 mg
41.	Copper	1.658 mg
42.	Iron	15.7 mg
43.	Magnesium	280 mg
44.	Manganese	2.517 mg
45.	Phosphorus	704 mg
46.	Potassium	1797 mg
47.	Sodium	2 mg
48.	Zinc	4.89 mg
49.	Water	8.54 g

2.9. Export Potential & Sales Aspect:

In 2019 there was a US$ 40.5 trillion in the global soy food industry. Soybean is a type of legume originating in East Asia, with a low saturation but a high protein content, vitamin C, and folate content. Today, the United States is one of the world's biggest soybean producers. Yet, compared with other nations, tofu is eaten at comparatively low amounts in the United States. According to the Soy Foods Association of North America, tofu sales during 2014 were $274 million in the United States. Tofu is largely eaten as an ethnic food or as a vegetarian alternative to meat and cheese that is rich in protein. Tofu, including hot dogs, sandwiches, ice cream, sauces, cookies, and shakes, can also be used in a number of other foods. Many varieties of tofu are available, including extra hard, firm, soft, and silken tofu. Extra firm and firm tofu, respectively, have textures comparable to fried meat and raw meat. In stir-fry dishes, grilling, and soups, their rigidity helps them to be used. Soft and silken tofu has soft and silky textures, and is delicate. It is possible to blend soft and silken tofu into sauces or use it as desserts or drinks. Fermented tofu, flavored tofu, grilled tofu, and frozen tofu are other forms of tofu. In terms of nutrition, tofu is free of cholesterol, low in saturated fat and rich in protein. Tofu contains approximately 50 percent protein and 27 percent fat on a moisture-free basis, most of which are polyunsaturated fatty acids. Tofu is a strong source of calcium as well. A soy health argument was endorsed by the U.S. Food and Drug Administration in 1999, and tofu has been proven to have multiple health benefits. Three ingredients consist of tofu: soybeans, water and a coagulant, usually nigari (magnesium chloride) or gypsum (calcium sulfate). Soy milk is the precursor to tofu, prepared with soybeans and water, the way milk is the precursor to cheese. To produce curds and whey, a coagulant is added to soy milk, equivalent to the way cheese is made. The coagulant is the only ingredient that can really control the taste. This recipe is also used to make Nigari, which has a mildly bitter flavor that many people tend to enjoy. Gypsum results in a less bitter taste which produces the same firm, smooth tofu as nigari, although this is not to your tastes (and it adds a lot of calcium to your block, too).

Global Tofu market is valued USD 2.42 billion in 2019. Expected to Grow at CAGR of 5.2% from 2019 to 2025. Tofu is considered a healthy and gluten-free food. Indian Tofu Market is expected to grow with 3.8% CAGR

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CHAPTER 3
PACKAGING

3.1. Shelf Life of Product:

Beyond the date stamped on the shipment, a package of fresh tofu will last 3-5 days, but there are also other items to remember. The shelf life of tofu depends on a number of factors, including the date of delivery, the process of processing and how to store the tofu. Tofu is made into soy milk from soybeans that are soaked, roasted, boiled and strained. It then curdles this milk and presses it into blocks. It is a common alternative to meat because tofu is plant based, but rich in protein and calcium. Because of its ability to digest other spices, it is a particularly strong substitute for chicken. For many vegetarians' dishes, all these qualities make it a common option for many.

Depending on the quality of the food, the longer food is processed, the flavour and nutrient quality reduces when first packaged. Studies have demonstrated, however, that freeze-dried and dehydrated foods, properly packed and sealed, preserve their calories, and calories, even if preserved beyond their allocated time, can sustain life in an emergency and avoid hunger.

The shelf life of stored foodstuffs depends on the following 4 major criteria:

- Temperatures: According to results from recent research, foods kept at room temperature or colder (75 °F/24 °C or lower) can be nutritious and edible for longer than commonly assumed. Foods processed (which is optimal) at 50 °F to 60 °F can last longer than foods stored at higher temperatures. Fire kills food and its nutritious value entirely. Proteins can break down and lose certain vitamins. The taste, colour, and smell of certain foods can change as well.
- Humidity: The explanation for dehydrated or freeze-dried long-term food preservation is to remove moisture. Too much moisture fosters a climate in which microorganisms can flourish and chemical reactions in food cause degradation that can eventually make us ill.
- Oxygen: Too much oxygen, especially in fats, vitamins, and food colours, can degrade food and encourage the growth of microorganisms. That is the explanation for the dry packaging of your own food items using oxygen absorbers.
- Light: Exposure to too much light will cause food to deteriorate. In specific, it influences the colour of food, the lack of vitamins, fats and oils, and proteins. Maintain long-term food storage in places with low light with the longest shelf life.

3.2. Soy Paneer/Tofu Packaging:

The functions of a package are to preserve the quality and freshness of food, to add appeal to the food to attract consumers, and to facilitate its storage and distribution. The basic functions required of a package can be grouped under five major categories.

3.2.1. To Contain the Product

The primary function of any package is to contain the food and facilitate handling, storage, and distribution all the way from the manufacturer to the ultimate user or even the time the rest portion is utilized by the consumer. However, there are usually various levels of packaging. A primary package is one that comes into direct contact with the contained product, e.g., metal cans, glass jars, and plastic pouches. By law, a primary package must not yield any substance that may be injurious to the health of the consumer. Further development to facilitate handling is to bundle a series of primary packages together, and this leads to the concept of secondary packages. An example of a secondary package is a corrugated box in which tins of apple juice are packed. As methods of handling and transportation have become more sophisticated, these secondary packages are often palletized and secured by strapping with metal or, more commonly, by shrink- or stretch-wrapped film to give yet another level of packaging tertiary packaging. In turn, these pallet loads may be packed into large metal containers, i.e., quaternary packaging for transportation over long distances by air, land, or sea. The secondary, tertiary and quaternary packaging is also known as packing.

The following are considered in this regard.

1. Adequate size and shape (biscuit package, tubs for detergent). Proper constructional features.
2. No leakage, spillage, diffusion, i.e. loss prevention.
3. Package: Must contain the commodity in natural form (biscuits packed in Pillow pack, prevent damage).
4. No subsequent damage after packaging during handling transportation and storage.
5. Thus, package must be strong enough to contain the commodity as it is.
6. Optimum compatibility (nontoxic, non-soluble with product… No physical, chemical, or biochemical changes/alteration… i.e. inert to the product.)
7. Containment or agglomeration - Small objects are typically grouped together in one package for reasons of efficiency. For example, a single box of 1000 pencils require

less physical handling than 1000 single pencils. Liquids, powders, a granule need containment.

3.2.2. To Protect the Product

One of the most important functions of any container is to protect the product contained against any form of loss, damage, deterioration, spoilage, or contamination that might be encountered throughout the distribution chain. Packaging can prevent physical damage, e.g., bruising caused by vibrational shocks during transportation or stacking in a warehouse. Proper packaging will also prevent material loss, e.g., potatoes from a weak sack or juice from a leaky can. Packaging can also protect products against moisture loss or gain, dust, and light, especially UV light, which causes deterioration of some light-sensitive products. It can also protect the package contents against temperature fluctuations in the transit of chilled and frozen foods. Packaging can also be used to control the availability of oxygen to fruits and vegetables and to protect against loss of flavour or fragrance and help products retain their nutritional value. Proper packaging may also protect the product against microbial spoilage by bacteria, yeasts, and moulds. It can also protect against microbiological spoilage of stored products due to rodents and insects.

3.2.3. Medium of communication

An important function of any food package is to identify the product and its origin; to inform the consumer how to use the contents; to provide any other information needed or required; and very importantly, to attract the user and encourage the purchase of the product. Package design has been an important and constantly evolving phenomenon for many years. Marketing communications and graphic design are applied to the surface of the package and in many cases the point of sale/display.

The information a package can convey to the consumer may include the following:

1. Product manufacturing and best buy dates
2. Proper storage conditions
3. Cooking instructions
4. Size and number of servings or portions per pack
5. Nutritional information per serving
6. Manufacturer’s name and address
7. Cost
8. Suggested recipes
9. Country of origin

10. Information transmission - Packages and labels communicate how to use, transport recycle, or dispose of the package or product.

Primary packages should have the following characteristics to facilitate the sale of products:

1. Sanitary
2. Non toxic
3. Transparent
4. Lightweight
5. Tamper evident
6. Easy to pick up and handle
7. Easy to fit into cupboards, shelves, refrigerators, etc.
8. Easy to open and dispense from
9. Easy to reclose
10. Returnable, recyclable, or reusable
11. Safe and presents no hazards in the way of broken glass or sharp jagged metal edges
12. Display the product
13. Glamorize: Create an illusion of something very precious, by decoration, Embossing techniques and exotic closures, but it should not deceive the people.

3.3. Packaging:

Packaging may be looked at as several different types. For example, a transport package or distribution package is the package form used to ship, store, and handle the product or inner packages. Some identify a consumer package as one which is directed toward a consumer or household. It is sometimes convenient to categorize packages by layer or function: "primary", secondary", etc.

1. **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 (viz. butter in parchment paper).
2. **Secondary packaging** is outside the primary packaging – perhaps used to group primary packages together (viz. paper board pack containing butter wrapped in veg. parchment paper).
3. **Tertiary packaging** is used for bulk handling, warehouse storage and transport shipping. The most common form is a palletized unit load that packs tightly into containers (viz. Boxes containing 20-25 or 50 butter packs are put together).

3.4. Packaging Material:

Soy Paneer requires protection from heat, light, O2, microbial contamination, moisture loss, odour absorption, acid resistance, and oil and grease resistance. Therefore, the package should have barrier properties and possible heat sealing.

- Vegetable parchment paper and PE bags are generally used for Soy Paneer packaging. PE gives greater keeping quality (7 days at 5^0C) than that given by vegetable parchment Paper.


- The Cryovac system using shrink film is being successfully used.

- Reportable tins are also used.

- Long-life can be given by Metallized polyester or Nylon – PET / MET PET/ PE or Aluminium foil or Nylon or LDPE/LLD.


- Soy Paneer is packed in tins along with the brine. These tins are sterilized and it may be having a slightly cooked flavour and Maillard browning which will increase with the storage period.

- Soy Paneer is also vacuum packed in laminated pouches to have an extended shelf.

CHAPTER 4
FOOD SAFETY & FSSAI STANDARDS

4.1. Introduction to 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 Departments. The FSSAI is responsible for setting standards for food so that there is one body to deal with and no confusion in the minds of consumers, traders, manufacturers, and investors. The Act aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command.

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.

The Act also aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi- level, multi- departmental control to a single line of command. To this effect, the Act establishes an independent statutory Authority – the Food Safety and Standards Authority of India with head office at Delhi. Food Safety and Standards Authority of India (FSSAI) and the State Food Safety Authorities shall enforce various provisions of the Act.

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.

4.2. FSSAI Registration & Licensing Process:

According to Section 31(1) of Food Safety and Standards (FSS) Act, 2006, Every Food Business Operator (FBO) in the country is required to be licensed under the Food Safety & Standards Authority of India (FSSAI).

As per FSS (Licensing & Registration) Regulations, 2011, Licenses and Registrations are granted to FBOs in a 3 tier system

- Registration - for petty FBOs with annual turnover less than Rs 12 lakhs
- State license - for medium-scale food manufacturers, processor and transporters
- Central License - for large-scale food manufacturers, processor and transporters

FSSAI registration is done online on the FSSAI website through Food Safety Compliance System (FoSCoS)

- FoSCoS has replaced the Food Licensing and Registration System (FLRS).
- Petty food business operators are required to obtain FSSAI Registration Certificate
- "Petty Food Manufacturer" means any food manufacturer, who manufactures or sells any article of food himself or a petty retailer, hawker, itinerant vendor or temporary stall holder (or) distributes foods including in any religious or social gathering except a caterer;

or

- Other food businesses including small scale or cottage or such other industries relating to food business or tiny food businesses with an annual turnover not exceeding Rs. 12lakhs and/or whose production capacity of food (other than milk and milk products and meat and meat products) does not exceed 100 kg/ltr per day

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 - 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
- Medium-sized food manufacturers, processor and transporters requires state FSSAI license.
- License period: 1 to 5 years as requested by the FBO.
- A higher fee for obtaining FSSAI license for more years.

- If a FBO has obtained the license for one or two years, renewal may be done, no later than 30 days prior to the expiry date of the license.

4.3. Food Safety & FSSAI Standards & Regulations:

"2.4.30. Non- fermented soybean products"

Tofu.- (a) Tofu is made by coagulating milky liquid obtained from soybean, and then pressing into soft white blocks. The milky liquid may be coagulated using magnesium chloride (nigari), calcium sulfate, calcium chloride, citric acid, acetic acid, magnesium sulfate and glucono -δ- lactone, reagents either in combination or individually. The product may contain spices or herbs whose standards are prescribed in sub – regulation 2.9 of Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011.

(b) It shall conform to the following standards:

Parameters	**Limits**
Moisture (% by mass), Max.	76.0
Total Ash (% by mass), Range	0.3-2.0
Protein (on dry basis) % by mass, Min.	8.0
Fat (% by mass), Range	2.0-5.0
Crude fiber (on dry basis) % by mass, Range	0.5-6.0
Titrable acidity Max. (as LACTIC ACID)%	1.5
Urease Index Value	0.05-0.2 pH Units Rise

Food Safety

Part I - General Hygienic and Sanitary practices to be followed by Petty Food Business Operators applying for Registration

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.

4.4. Labelling Standards (Regulation 2.5 of FSS)

Labelling requirements for packaged food products as laid down in the Part 2.4 of the Prevention of Food Adulteration (PFA) Rules, 1955, and the Standards of Weights and Measures (Packaged Commodities) Rules of 1977, require that the labels contain the following information:

1. Name, trade name or description
2. Name of ingredients used in the product in descending order of their composition by weight or volume
3. Name and complete address of manufacturer/packer, importer, country of origin of the imported food (if the food article is manufactured outside India, but packed in India)
4. Nutritional Information
5. Information Relating to Food Additives, Colors and Flavors

6. Instructions for Use
7. Veg or Non-Veg Symbol
8. Net weight, number or volume of contents
9. Distinctive batch, lot or code number
10. Month and year of manufacture and packaging
11. Month and year by which the product is best consumed
12. Maximum retail price

Provided that — (i) the nutritional information may not be necessary, in case of foods such as raw agricultural commodities, like, wheat, rice, cereals, flour, spice mixes, herbs, condiments, table salt, sugar, jaggery, or non –nutritive products, like, soluble tea, coffee, soluble coffee, coffee-chicory mixture, packaged drinking water, packaged mineral water, alcoholic beverages or flour and vegetables, processed and pre-packaged assorted vegetables, flours, vegetables and products that comprise of single ingredient, pickles, papad, or foods served for immediate consumption such as served in hospitals, hotels or by food services vendors or halwais, or food shipped in bulk which is not for sale in that form to consumers.

Wherever applicable, the product label also must contains the following

The purpose of irradiation and license number in case of irradiated food. Extraneous addition of colouring material.

Non-vegetarian food – any food which contains whole or part of any animal including birds, fresh water or marine animals, eggs or product of any animal origin as an ingredient, not including milk or milk products – must have a symbol of a brown color-filled circle inside a brown square outline prominently displayed on the package, contrasting against the background on the display label in close proximity to the name or brand name of the food.

Vegetarian food must have a similar symbol of green color-filled circle inside a square with a green outline prominently displayed.

All declarations may be: Printed in English or Hindi on a label securely affixed to the package, or Made on an additional wrapper containing the imported package, or Printed on the package itself, or May be made on a card or tape affixed firmly to the package and bearing the required information prior to customs clearance.

Exporters should review the Chapter 2 of the “FSS (Packaging and Labelling) Regulation 2011” and the Compendium of Food Safety and Standards (Packaging and Labelling) Regulation before designing labels for products to be exported to India. FSSAI revised the

labelling Regulation and a draft notification to that effect was published on April 11, 2018, inviting comments from WTO member countries and the comments received are under review and the publication date remains unknown.

According to the FSS Packaging and Labelling Regulation 2011, “pre-packaged” or “pre packed food” including multi-piece packages, should carry mandatory information on the label.[iii]

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 Udyog Aadhar;

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.[iv]

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[iii] https://www.fssai.gov.in/

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