Ministry of Food Processing Industries
Government of India

सत्यमेव जयते

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PROCESSING OF SOYACHUNKS

AATMANIRBHAR BHARAT

PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)

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INTRODUCTION

INDUSTRIAL OVERVIEW

- Soybean or *Glycine max L* is a legume plant that originated in eastern Asia.
- Another commodity in the processing of soybean crops is soy vegetable oil used in the food and industrial applications, contributing to 25% of the global edible oil.
- 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.
- mostly grown in Madhya Pradesh though also cultivated in states such as Chhattisgarh, Gujarat, and West Bengal is a large area.

INTRODUCTION

PRODUCT DESCRIPTION

- Soya chunks or chunks are made of soy flour, which is a by-product of soy oil extraction.
- Due to its good nutritive values, and medicinal qualities, soy chunks, and related food products became popular all over the world.
- It has the same protein content as meat, and also similar chewy in texture.
- They are also free from cholesterol.

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MARKET POTENTIAL

- The market for soya nuggets is rising as healthcare-conscious.
- new players of the market have begun to deliver soya chunks, older players have increased demand power.
- In India, the soy nugget market is rising annually at a rate of between 25% and 30%, leading businesses to become more aggressive.
- In the household as well as in commercial food joints, hostels, hospitals, protective cuisines, and others, the demand for Soya Nuggets has increased due to its high content of proteins, cheap price, and taste as well as easy-to-cook nature.
- The soy granules have various domestic uses in food and beverage preparation in different regions.
- The global soybean market will increase from US$146.23 Billion in 2017 to US$215,746 Billion by 2025, at a CAGR of 5.0 percent over the period between 2017 and 2025.

INTRODUCTION

RAW MATERIAL DESCRIPTION

- Soya flour or soybean can both be used as raw material.
- The conversion of soy flour into defatted soy flour, then the actual soy chunks manufacturing process can start.
- Defatted Soya Flour (Toasted) is obtained from selected, pre-cleaned, cracked, dehulled, and solvent 'NON-GMO' soybeans harvested by milling.
- HDPE Bag with inner liners (food grade) is required, and to pack those bags for transportation in bulk, cardboard boxes are required.

INTRODUCTION

TYPES OF RAW MATERIAL:

YEAR OF NOTIFIED	NAME OF VARIETY	STATE
	Chhattisgarh Soybean-1 (CG Soya-1)	Chhattisgarh
2018	JS-2098	MP, UP, Raj, Gujarat, Maharashtra
	Kota Soya-1 (RKS-113)	Assam, WB, Jharkhand, CG, NE State
	DSB 23	
	KS-103	KK, TN, Telangana, AP, Maharashtra
	MAUS 612	Maharashtra and south India

INTRODUCTION

TYPES OF RAW MATERIAL:

YEAR OF NOTIFIED	NAME OF VARIETY	STATE
	Raj Soya-24 (RVS 2002-4)	MP, Maharashtra, Rajasthan, UP
	Pant Soybean-24 (PS-1477)	UP and Uttarakhand
	Pant Soybean-21 (PS-1480)	Uttarakhand
2017	Pant Soybean-23 (PS-1523)	Uttarakhand
	Raj Soya-28 (Pragya)	MP
	JS-2069	MP

INTRODUCTION

TYPES OF RAW MATERIAL:

YEAR OF NOTIFIED	NAME OF VARIETY	STATE
2016	VL Soya-77 (VLS-77)	
	VL-Bhat-201 (VLB-201)	Uttarakhand
	NRC-86 (Ahilya-6)	MP, Rajasthan, Gujarat, UP and Maharashtra
	KDS-344 (Phule Agrani)	Maharashtra, Karnataka, TN, & Telangana
	DSB-21	Karnataka, TN, AP, Kerala, Maharashtra
	Pusa-12 (DS-12-13)	Punjab, Haryana, Delhi, UK, Bihar, UP
2015	SL-958	Punjab

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PROCESS & MACHINERY REQUIREMENT

RAW MATERIAL ASPECTS

- Defatted soy flour is used for making chunks.
- For this the defatted soy flour is crucial to facilitate dry milling required for dry fractionation.
- To defat the soybeans by organic solvent extraction, soybean seeds are first coarsely milled into soy grits with a mill. Then a batch of soya grits is immediately defatted by using industrial Soxhlet extractor using petroleum ether (40-60°C boiling range) with a sample-to-solvent ratio of 1:4 for 6 hours. The defatted soy grits were left overnight in a fume hood to allow complete evaporation of the residual petroleum ether.
- Alternatively, a single-screw oil press defats whole soybeans. Cooling was applied during pressing to keep the temperature at 60 0 C and thereby prevent potential heat damage during pressing. Defatted soy cakes are collected for further use

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PROCESS & MACHINERY REQUIREMENT

SOURCES OF RAW MATERIAL

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

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PROCESS & MACHINERY REQUIREMENT

SOURCES OF RAW MATERIAL

S. NO.	STATES	KHARIF 2020		
		Sowing Area	Expected Yield	Estimated Production
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**

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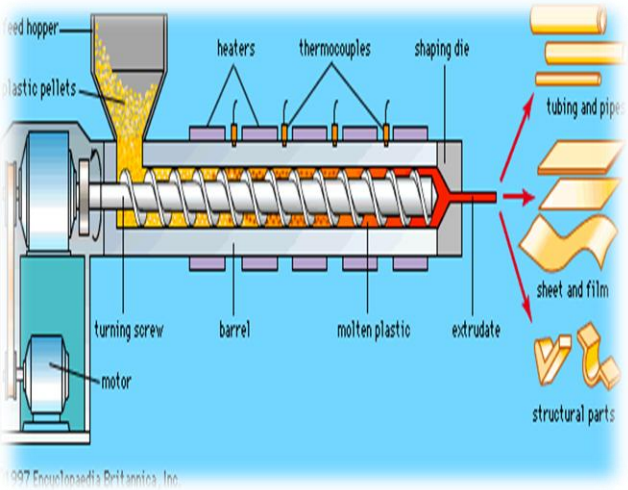
PROCESS & MACHINERY REQUIREMENT

TECHNOLOGIES

COOKING EXTRUSION TECHNIQUES



A screw mechanism in a tube or barrel that conveys the dough to small openings called a die.

The dough is compressed and heated to high temperatures at high pressures in the confined space of the barrel until it is extruded into the atmosphere through dying.

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TECHNOLOGIES

COOKING EXTRUSION TECHNIQUES

- It has following features:

- Feeding device
- The screw system and barrel design
- The dimensions and number of dies
- Extruding handling device.

Cooking methods perform other essential function in addition to texturization and restructuring such as protein denaturation , reduction in beany flavour, homogenizing and shaping the product

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TECHNOLOGIES

DRYING TECHNOLOGY

- The drying process is necessary to reduce product moisture to required level is one of key step.
- The aim of dehydration is to reduce degradation and inhibit microbial growth.
- The method of drying is very complex as it requires the simultaneous transfer of heat, mass, and momentum, by moisture from the foodstuff and by hot air.

PROCESS & MACHINERY REQUIREMENT

TECHNOLOGIES

DRYING TECHNOLOGY

- Several parameters and product design affect this operation:
- Dryer
- System pressure
- Dry air temperature
- Speed and relative humidity
- Type and concentration of solutes of product

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MANUFACURING PROCESS

➢ **DEFATTED SOYA FLOUR STORAGE BEFORE PROCESSING**

- Defatted soya flour is hard to handle because of poor flow ability and bridging characteristics.
- Several processors are micro-millers and follow the policy of keeping shorter/smaller stocks to make available enough raw materials only for few batches. The speculative character of the markets also contributes to high procurement costs.

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MANUFACURING PROCESS

➢ FLOUR BLENDING AND PRECONDITIONING

- A screw conveyor is generally used for intake and transfer to conditioner or mixer.
- The raw material passes through the pre-conditioner or mixing cylinders where moisture can be applied with moisture content of 10 -25%.
- If steam is applied it is carefully injected in raw material at a temperature between 65°C and 100°C.
- flavors, colouring agents and other additives may also be added at that time to ensure continued mixing.

PROCESS & MACHINERY REQUIREMENT

MANUFACURING PROCESS

➢ **DRYING**

- The moisture content in the extrusion processing of textured proteins is high and cooked product must be dried.
- Dryers with different lengths, widths, and passes allow proper sizing and versatility of installation on existing or new installations for the extruder production.

➢ **COOLING**

- Once the product comes out of dryer, it is still is not cool enough for packaging. A cooling conveyor with several cooling fans used generally.

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MANUFACURING PROCESS

➢ **PACKAGING OF PRODUCTS**

- After the proper drying process, the chunks are ready for the packaging by using appropriate packaging material, the soya chunks are packed according to market demand in various size bags.

PROCESS & MACHINERY REQUIREMENT

FLOW CHART

STEPS	MACHINE NAME	DESCRIPTION	MACHINE IMAGE.
Storage before processing	Flat storage or vertical silos	Store the raw material (Defatted Soya Flour)	
Mixing/ Blending and pre-conditioning	Blender	The raw material passes through the pre-conditioner or mixing cylinders where moisture can be applied evenly in water or steam, with a moisture content of 10 to 25%.	

PROCESS & MACHINERY REQUIREMENT

FLOW CHART

STEPS	MACHINE NAME	DESCRIPTION	MACHINE IMAGE.
Cooking Extrusion	Soya Cooking Extruder Machine	Used for cooking extrusion of soy flour so as to obtain nuggets.	
Drying	Dryers	Dryer used for reducing the moisture content of the final product.	
Cooling	Cooling conveyor	A cooling conveyor with several cooling fans used generally.	

PROCESS & MACHINERY REQUIREMENT

FLOW CHART

STEPS	MACHINE NAME	DESCRIPTION	MACHINE IMAGE.
Packaging	**Automatic weighing and packaging machine**	This is automatic machine used for weighing and packaging of soya nuggets according to market demand.	

PROCESS & MACHINERY REQUIREMENT

ADDITIONAL MACHINES AND EQUIPMENTS

MACHINE NAME	DESCRIPTION	MACHINE IMAGE.
Screw Conveyor	Used horizontally or at a slight incline as an efficient way to move semi-solid materials.	
Belt Conveyor	used in transportation of bulk materials	
Heat Exchanger	Heat exchangers are used in both cooling and heating processes	

GENERAL FAILURES & REMEDIES

GENERAL FAILURES	REMEDIES
Mechanical Key Failure	•Ensure that mechanical keys are replaced as per there pre-defined operational life. •Prevent Overloading.
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.

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Extruder Barrel Jamming	• This failure rises due to improper cleaning or maintenance. The most simple remedy is cleaning.

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NUTRITIONAL INFORMATION

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

S.NO	NUTRIENTS	Quantity
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

PROCESS & MACHINERY REQUIREMENT

NUTRITIONAL INFORMATION

S. NO	NUTRIENTS	Quantity
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

S. NO	NUTRIENTS	Quantity
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

PROCESS & MACHINERY REQUIREMENT

EXPORT POTENTIAL & SALES ASPECT

- With health-conscious foods in mind, soy foods are an excellent alternative to milk, meat, and poultry-intensive diets.
- In 2019 there was a US$ 40.5 trillion in the global soy food industry.
- soya is usually used in many recipes as an alternative to meat and is added to various vegan-friendly foods. . The growing demand for plant-based foods confirms the soy market growth worldwide.
- Demand for tofu in particular for vegans and vegetarians is currently rising throughout the world. The lactose-intolerant user will eat as excellent replacement for cheese.

PROCESS & MACHINERY REQUIREMENT

EXPORT POTENTIAL & SALES ASPECT

- companies invest in R&D to launch new varieties of soy foodstuffs to extend their product range and draw new customers.

- According to recent data, almost 80% of consumers have tried some of the most popular soy food items or drinks. Given these factors, over the forecast period 2020-2030, the global soy food market is forecast to expand in an impressive CAGR.

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OPPORTUNITIES FOR MICRO/UNORGANIZED ENTERPRISES

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:

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OPPORTUNITIES FOR MICRO/UNORGANIZED ENTERPRISES

PM – FME SCHEME

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.

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