

RAJASTHAN AGRICULTURAL COMPETITIVENESS PROJECT



Detailed Project Report on Isabgol Husk



Prepared by:



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AGRI BUSINESS PROMOTION FACILITY

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Executive Summary

The development objective of Rajasthan Agriculture Competitiveness Project (RACP) is to sustainably increase agriculture productivity and farmers' incomes in several selected locations of Rajasthan. As a part of this approach, several Farmer Producer Companies (FPCs) have been developed and supported under the project. Each of these companies will have primary and/or secondary (value adding) processing infrastructure (Farmer Common Services Centers (FCSCs)), services of which will be availed by farmers of their cluster region. Broadly, these companies will aggregate produce of farmers, process/value add and directly sell in bulk to processors/consumers. This, in turn, will enable farmers to realize higher and better remuneration for their produce. In a nutshell, the envisaged FCSCs will have micro or small scale milling/processing and packaging units to facilitate services to farmers.

Naturally, existing and upcoming agro and food processing units in the state play a highly important role in the scheme of things, i.e. forward linkages in agriculture. Evidently, higher investments in such agribusinesses will bolster development and sustainability of FPCs and farmers thereto. In line with the approach, RACP, through its Agri-Business Promotion Facility (ABPF), aims at:

- Promoting agribusiness investments in the state
- And providing incubation facilities to foster innovation & entrepreneurship

The objective of this report is “scouting of technologies and suitable replicable models” in Isabgol processing. Broadly, the report aims to provide some insights, to prospective entrepreneurs and existing unit holders in the state - on technological gaps identified in existing units, on several technological advances in the industry, on benchmarking technology and efficiency vis-à-vis industry bests in other parts of the country and providing suitable replicable models at small scale processing.

“*Plantago ovata*” commonly known as ‘Psyllium’ in English and ‘Isabgol’ in Hindi belongs to the family of Plantaginaceae, is a 10-45 cm short-stemmed annual herb known by different names such as ashwagolam, aspaghol, aspagol, bazarqutuna, blond Psyllium. Isabgol has high fiber content and acts like a sponge serving to clean the bowels and is extensively cultivated in many parts of the globe. It is commercially an important Rabi season crop known for its medicinal properties. Apart from its husk (The seed coat is known as “husk”) it is also being used in food

industry especially in ice creams, biscuits and candies. The crop is mainly cultivated in the states of Rajasthan, Gujarat, Haryana and Madhya Pradesh.

Notably, India ranks first in Isabgol production (98%) and is the sole supplier of seeds and husk in the international market. Among medicinal plants, Isabgol is the first ranked foreign exchange earner for the country (Rs.30 million annually). It contains a significant amount of proteins and husk yields colloidal mucilage which are valued for medicinal application and is used in Aryurvedic, unani and allopathic systems of medicines. USA is the chief importer of Isabgol seeds and husk from India. The crop has a large export demand in USA and Western Europe and about 90% of the production is exported to these countries.

Rajasthan is one of the major Isabgol producing states in India after Gujarat. The state ranks first in terms of area and production in the country. Isabgol thrives well in warm temperate region and requires cool and dry weather during its crop season hence generally it is sown during winter months. It grows well in saline soils with poor quality water in western Rajasthan as Rabi crop. The water requirement is low as compared to traditional crop thus, making it suitable for such areas. It matures in about 120 days (November to Feb-March). The spikes are harvested when they turn red. Isabgol products available in the market are used as laxative that is particularly beneficial in constipation, chronic ailments and dysentery. Seed prices are not governed by any regulations and are solely dependent upon the farmers. The average price of the seed is around Rs 80 to Rs 95 per kg. The crop covers 214188 hectares with the production of 113344 ton and average productivity of 529 kg/ha (Vital Agriculture Statistics, 2011-12) in the state.

RI-87, RI-89, AMB-2, GI-1, GI-2, GI 3, MIB-4, HI-34, HI-2, HI-1, HI-5, JI-4 and Niharika are the major varieties of Isabgol grown in India. Gujarat Isabgol-1, variety yields 800-900 kg of seeds per hectare.

Some key weakness in the Isabgol value chain are: Scanty and erratic rainfall affects production, cost of input and labor is very high, harvested seeds need to be kept safe from moisture and non-availability of major Mandi and processing hub in Rajasthan. Eventually, all the seeds reach Gujarat for further processing.

Some key opportunities in Isabgol value chain are: Support through RACP will help improve crop productivity management, water management, and post-harvest management along with opening up opportunities for local value addition. Scope of establishment of FCSC would help in increasing the share of farmer over consumer rupee.

Some of the major challenges of the Isabgol value chain are: It's a high risk crop, the entire crop gets damaged in case of bad weather, Price volatility hampers the mood of farmers. Currently, the farmers share in consumer rupee is very low due to the high level of value addition done in the

post-harvest value chain. The farmers share is 9%, traders enjoy a share of around 1% processors 47%, health care companies 22%, distributors -8% and retailers 13%.

The pre and post intervention value chain for the commodity may be viewed as follows:

- **Pre Intervention Value Chain: Isabgol**

The pre intervention value chain of Isabgol has essentially three channels. Though farmers sell the seed either in the local Mandi or to the village level traders, eventually, all stock find their way to Unjha Mandi, Gujarat from where they are taken by processors. From here, the channel divides into three parts. The 1st part is for domestic markets where Pharma/healthcare companies take the Isabgol either from the processor directly or through distributors and sell it in their branded and packaged form. The 2nd channel includes both processors and distributors, involved in export market which is eventually 90% of the total market share of production across the globe. The third channel is of the animal feed sector, where the animal feed processors take the balance part of the seed to use as animal feed and further distribute it through their channel after mixing it with other feed materials.

- **Post Intervention Value Chain: Isabgol**

The indicative post intervention value chain suggests FPC to undertake procurement from farmers and sell Isabgol Husk after sorting, grading & Processing directly to Traders on B2B basis or direct export to the international destinations. When the FPC gains experience and understands the dynamics of the front end of the market, they may also enter into Isabgol husk making and supply it directly to Traders or Buyers such as Procter & Gamble, Jyotindra International etc. so that they may earn higher margins.

Constraints and intervention plan may be considered in context of 3 stages/activities, namely the production, post-harvest and processing stage. The constraints may be viewed in terms of rains during harvesting resulting in crop damage and high cost of inputs. These may be addressed through weather broadcasting service and provisioning of improved quality seeds through FPC and FCSC.

In view of above, technological intervention becomes imperative. This report aims at suggesting technology based business model which can act as a reference source for the entrepreneurs aiming to start micro size Isabgol Husk Processing Plant.

Considering the quantum of investment, the report outlines one project profiles that could be referred by entrepreneurs as an option. Section 5.1 of Chapter 5 showcase the financial feasibility of the projects

- a. **Profile 1:** Highlights a small scale model that can be pursued as guiding model by small farmers or individual entrepreneurs, farmer groups, farmer producer association/companies. The technology proposed for this segment involves Mini Semi-Automatic 2 TPD Capacity Isabgol Husk manufacturing unit which comprises of a Storage Silos, cleaning machine, De-Stoner, Gravity Separator, material handling equipment's, aspiration system, cabling and control panel, and packing machine. The total cost of the complete set of Main P&M, on basis of some referred quotations of leading suppliers in the segment, is Rs 339.94 Lakhs. This cost is inclusive of taxes, transportation, installation and commissioning charges.

RACP-ABPF shall undertake mix of some or several initiatives to disseminate the suggested technologies and models, which may broadly include:

- Workshops for prospective entrepreneurs/groups, existing industry owners and BoDs of FPCs
- Facilitate technology benchmarking exposure visits within and outside state for prospective entrepreneurs/groups, existing industry owners and BoDs of FPCs
- Seminars and Workshops in association with Industry Associations, Technical Institutes and R&D Institutions
- Technology Meets and Tie-ups with Technology Suppliers, Technical Institutes and experts
- Facilitate through consultancy and business development services
- Dissemination of success stories of units facilitated by ABPF through appropriate media
- Dissemination through web portals and mobile applications

The models and business plans suggested in this report are broadly generic in nature, however involve:

- Technology profile
- Civil works requirement
- Raw material sourcing and logistic costs for sourcing raw material
- Capacity utilization for different scenarios
- Realistic assessment of investment and working capital needs
- Possible sources of funding
- Financial analysis

The suggested models and business plans are for optimal capacities that can be fine-tuned to the scale, investment, technology needs of the entrepreneur. ABPF will further guide entrepreneurs on statutory clearances needed for operating the business, required licenses, ways of leveraging various government schemes/subsidies and several other aspects for effective technology adoption. In order to increase the scale and potential adoption, ABPF shall pursue some or mix of several initiatives, which may broadly include:

- Investor road shows
- B2B Meets
- Establishing Mentor Network
- Mentor-Mentee Workshops
- Facilitating Access to Finance
- Creating a robust knowledge base
- Preparation of business plans
- Review of business plans for funding through RACP

Chapter 1- Introduction

1.1 Introduction on Isabgol

The word *Plantago ovata* is derived from Latin, *Plantago* meaning 'sole of the foot', and *ovata* refers to the shape of the leaves. *Psyllium* is a Greek origin word, meaning 'Flea' regarding to the color, shape and size of seeds. *Isabgol* is derived from Persian word with meaning of 'horse ear' because of boat shape of seeds



Figure 1: Isabgol Plantation & Isabgol Plant

Plantago ovata commonly known as 'Psyllium' in English and 'Isabgol' in Hindi belongs to the family of *Plantaginaceae*, is a 10-45 cm short-stemmed annual herb is known by different names such as ashwagolam, aspaghol, aspagol, bazarqutuna, blond Psyllium. Isabgol have the best quality and highest fiber content. It is an exceptional fiber because it acts like a sponge serving to clean the bowels and is expansively cultivated in many parts of the globe. Shrubby perennial plants with narrow green leaves put up spikes of small flowers that mature into seedpods.

The species of Isabgol is indigenous to India, Pakistan and introduced it as medicinal plant by Muslims. Therefore, first time it was brought under cultivation in cities of Pakistan i.e., Lahore and Multan. Initially the people of Asian countries used it as a remedy for chronic dysentery and other intestinal problems. India is the largest producer as well as exporter of Isabgol seeds and husk. It is commercially an important Rabi season crop known for its medicinal properties. Apart from its husk (The seed coat is known as "husk") it is also being used in food industry especially in ice

creams, biscuits and candies. The crop is mainly cultivated in the states of Rajasthan, Gujarat, Haryana and Madhya Pradesh.

1.2 Global Scenario

Isabgol is economically an important medicinal plant commonly cultivated in different parts of India, Pakistan and Iran and some part of Europe. It has been used in Asia and Europe since 16th century as an herbal medicine for chronic constipation. It has also been used in Chinese and Indian traditional system of medicines as safe laxative and reduces the risk of developing chronic diarrhoea, dysentery and other intestinal disorders. The seed husk does not irritate the intestine and has specific curing properties when mucous membrane is disturbed by inflammatory infections. Moreover, plant is regarded as a remedy for various ailments in traditional system of medicine in different parts of the world. Mucilage of the dried seed is used externally as an emollient in different parts of the world whereas in Iran water extract of dried seeds used externally for inflammation and orally taken seeds used for indigestion associated with bile secretion abnormalities. In Thailand and Spain, seeds of this plant used in different ways for the treatment of ailments like cold, diarrhea and chronic constipation.

In developing countries agriculture sector has promising effects on economic growth, because of medicinal and pharmaceutical application of Isabgol, it has a high value of market demand and in view of increasing market demand, cultivation of this plant at country level or worldwide is utmost important for uplifting the economy of a country. The crop has a large export demand in USA and Western Europe and about 90% of the production is exported to these countries. India is the largest producer as well as exporter of Isabgol in the world. India provides about 85% of the Isabgol available in the world market.

1.3 Indian Scenario

Isabgol is one of the most important medicinal crops grown for its husk. Mucilage yield amounts to approximately 25% or more (by weight) of the total seed yield. Isabgol seed mucilage is often referred to as husk or Psyllium husk. The milled seed mucilage is a white fibrous material that is hydrophilic (water- loving). India ranks first in Isabgol production (98%) and the sole supplier of seeds and husk in the international market. Among medicinal plant, Isabgol is the first ranking foreign exchange earner for the country (Rs.30 million annually). It contains a significant amount of proteins and husk yields colloidal mucilage which are valued for medicinal application and used in Aryurvedic, unani and allopathic systems of medicines. It is an annual herb and cultivated in Rajasthan, Gujarat, Madhya Pradesh & Haryana.

India is the largest producer and the main supplier of seed and husk to the world market. USA is the chief importer of Isabgol seeds and husk. The crop has a large export demand in USA and Western Europe and about 90% of the production is exported to these countries. Also, the growing of this crop in winter season will not affect the production of succeeding monsoon crop and thus fits well in the cropping system. The seed husk finds variety of industrial applications. It is the main

constituent of a number of laxative preparations containing sodium bicarbonate and various flavor's used in modern medicine.

On account of the remarkable property of mucilage from seed husk as a thickener, it could be used as such in food industries. It is employed as a basic stabilizer in ice-creams and as an ingredient of chocolates and other food products. It is also used for sizing purpose and as a base in cosmetics. The husk has been found to be served as a good binder and disintegrated in compressed tablets. On treatment with hot caustic soda solution and subsequent, the seed husk produces jelly which provides a substitute for agar-agar. Isabgol seed gum has been used to prepare dry dentifrice powder and germicidal lubricating gels. It has also been successfully employed in composition for petroleum. Water resistant explosive compositions can be prepared with Isabgol seed gum alone or in admixture with other gums. When mixed with guar, seed husk can be used as some cattle feed particularly in cases of lactating animals. The DE husked seed is around 69% by weight of the total seed crop which is used as a bird-feed.

Earlier, Gujarat used to enjoy an absolute monopoly over Isabgol production, with the crop being cultivated in Banaskantha, Kutch, Mehsana and Jamnagar districts of the state. Later, as the demand started shooting up, farmers in Rajasthan – which also has a similar conducive environment and soil conditions for Isabgol – also took up cultivation of this crop. Presently Gujarat, Rajasthan, Haryana and Madhya Pradesh are the only states in India involved in Isabgol production, with about 60,000 hectares under Isabgol cultivation in the states of Gujarat and Rajasthan put together. While, over the years, climatic, pricing and cost vagaries have led to dwindling cultivation in Gujarat, the same in Rajasthan is striving, with the latter edging out the former in Isabgol production. Over the last five years, Gujarat's share in Isabgol production has declined from 35% of the total output in India to 20%, with both Rajasthan and Madhya Pradesh augmenting their output and share India's total production of Isabgol is about 1.3 lakh MT. Of this, while Gujarat accounted for about 33,000 MT in FY2008 its production goes down to 20,000 MT in FY2014.

1.4 Rajasthan State Scenario

Rajasthan is one of the main Isabgol producing states of India. The state ranks first in terms of area and production in the country. The mucilage has medicinal properties and used against constipation, irritation of digestive track etc. The left over material of seed after husk removal is used as animal feed. Isabgol thrive well in warm temperate region and requires cool and dry weather during its crop season hence generally it is sown during winter months. It can be grown well in saline soils with poor quality water in western Rajasthan as Rabi crop. The water requirement is low as compared to traditional crop makes it suitable for such areas. It matures in about 120 days (November to Feb- March).

Rajasthan produces 67% of the Isabgol and rest is by Gujarat 33%. The spikes are harvested when they turn red. The average yield comes to 800-1000 kg/ha. Isabgol products available in the market are used as laxative that is particularly beneficial in constipation, chronic ailments and

dysentery. Seed prices are not governed by any regulations and are solely dependent upon the farmers. The average price of the seed is around Rs.35 to Rs.55 per kg. The total area under Isabgol cultivation in Rajasthan was 123746 Ha and production was 68872 tonnes in the year 2008-2009. At present the crop covers 214188 hectares with the production of 113344 ton and average productivity of 529 kg/ha (Vital Agriculture Statistics, 2011-12) in the state. However, Isabgol cultivation under arid condition with sandy loam soil is a profitable venture, which is gaining popularity among the farmers of western Rajasthan.

1.5 Scenarios at Various districts & Clusters of Rajasthan

The important Isabgol producing districts of in Rajasthan includes Barmer, Jalore followed by Nagaur, Chittorgarh and Jaisalmer.

Table 1:Major Isabgol producing districts in Rajasthan

Total Production in the catchment Area (2015-16)	37127
Total Production in Rajasthan (2015-16)	117587
Percentage share in the State Production	31.57
Top Producing Districts in the catchment zone	Nagaur, Chittorgarh, Jaisalmer

The important Isabgol producing districts in Catchment area includes Nagaur, Chittor followed by Jaisalmer, Pratapgarh, Jhalawar and Jaisalmer as shown in Figure below.

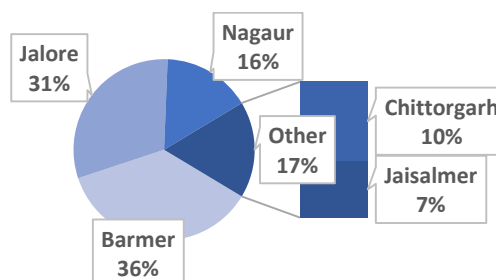


Figure 2:Isabgol Production in Catchment areas of Rajasthan (In %)

As far as catchment area is concerned Nagaur leads in terms of production followed by Chittor & Jaisalmer. Below mentioned table shows the district wise production data in MT.

Table 2:Major Isabgol producing districts in Rajasthan

District	Production (MT)
Nagaur	16712
Chittor	10614
Jaisalmer	7637
Partapgarh	1489
Jhalawar	398
Bikaner	202

The estimated area of Isabgol in Ladhun cluster is 1190 Ha in 2016-17 and the estimated production is 855 MT and the entire production is a marketable surplus for the farmer as he cannot process any portion of this on his own. The Marketable value of this Isabgol seeds is Rs 897 lacs.

Table 3:Area, Production and marketable surplus of Isabgol in Value Chain Cluster

Cluster	Area (Ha)	Production (MT)	Marketable surplus (MT)	Market value Rs lacs
Ladhun	1190	855	855	897

1.6 Global Scenario & National Scenario: Isabgol Husk market

India leads the global production as well as is the number one exporter in the world.

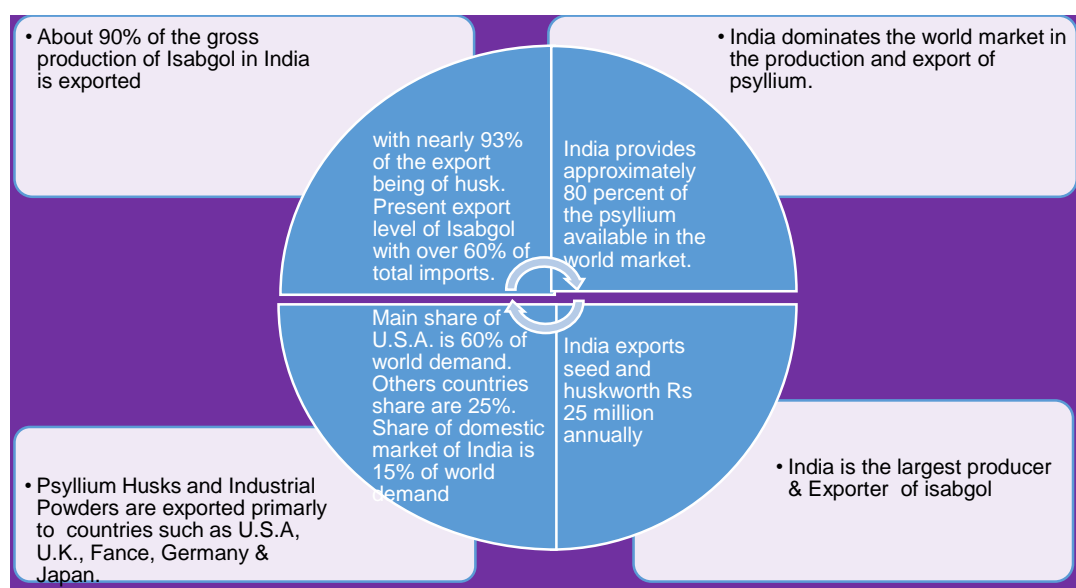


Figure 3:Isabgol Import Export Market

From the data given above it is evident that India is the world leader in Psyllium in terms of production as well as exports. The largest buyer of Isabgol from India is the United States, accounting for around 75% of the total husk exports from India. Germany is the largest single importer of seed. Psyllium research and field trials in the U.S. have been conducted mainly in Arizona and also in Washington. In India, Gujarat contributes 35% of world production of Psyllium Husk. In India, Gujarat and Rajasthan states are the major producer states of psyllium. Psyllium husk is obtained from the genus *Plantago*. The husk is commercially used for mucilage production used in laxatives and other applications of the same. The psyllium plant is native to South East Asia with India dominating the production by volume globally. The psyllium is high in soluble fiber content with a detoxing effect over the digestive system, making it a very apt nutraceutical. Psyllium husk is available in powder and as the whole husk. Psyllium husk dust is produced during the production of psyllium husk powder, which has application in construction and animal feed industry. The psyllium husk market is expected to be dominated by the North America region owing to its large laxative drug and supplement market. The natural origin of the psyllium husk and offering in organic is anticipated to drive the market over the forecast period.

Table 4: List of importing markets for a product exported by India (Psyllium Husk: -12119032)- Growth in Quantity

Importers	Exported growth in quantity between 2013-2014, %	Exported growth in quantity between 2014-2015, %	Exported growth in quantity between 2015-2016, %	Exported growth in quantity between 2016-2017, %	Exported quantity in 2017, Kilograms
World	-25	3	2	2	36487471
USA	-13	3	5	-8	15476898
Germany	30	-3	17	19	5369965
Italy	20	39	-1	23	2027899
United Kingdom	4	36	-27	-6	1231352
China	7	18	16	27	983955
Belgium	-1	-22	116	-19	880418
France	19	-21	-12	25	870327
Mexico	-13	-4	12	-44	812500
Australia	-18	-4	-4	-1	791505
Pakistan	-79	-60	-69	134	748444
Korea, Republic of	-22	40	5	39	611776
Malaysia	-10	78	4	-29	588624
Bangladesh	93	31	-38	-3	564255
Denmark	-28	54	-45	47	563150
Canada	-19	30	7	8	458257
Ireland	-81	8	500	24	406306
Austria			214	-10	399000
Afghanistan	44	148	25	291	385110
Japan	32	-28	-19	15	369605
Spain	-18	15	18	26	263715
Poland	63	-15	31	59	250275
United Arab Emirates	-34	-2	-7	54	221836

Thailand	58	-3	26	8	214386
Brazil	-27	-22	12	64	202065
Colombia	3	20	-42	70	161500
Guatemala	-39	-13	-18	40	145300
Taipei, Chinese	-18	29	-5	-35	116250
Saudi Arabia	18	29	-35	5	104502
Netherlands	429	144	14	11	102598
Costa Rica			-13	8	99000
Finland	-61			238	88600
Czech Republic	2666	10	1	-33	84600
Philippines	-6	-28	-22	15	79055
Romania	-8	29	-23	22	74300

Importers	Exported growth in quantity between 2013-2014, %	Exported growth in quantity between 2014-2015, %	Exported growth in quantity between 2015-2016, %	Exported growth in quantity between 2016-2017, %	Exported quantity in 2017, Kilograms
Indonesia	50	19	-39	-63	63345
Iran, Islamic Republic of	4	730	-65	0	61000
Turkey	977	30	39	0	58503
Sweden	-86	47	174	-19	54575
Lithuania	49	5	0	14	50000
South Africa	84	80	-59	-11	49015
Singapore	-12	13	-19	-7	38040
New Zealand	223	-33	-4	25	37234
Qatar	126	3	431	16	36004
Hungary	-19	119	-21	-8	34700
Russian Federation	31	75	1938	-67	27958
Latvia			-95	1900	20000
Chile	290	-42	-59	100	18000
Egypt	-67	150	19	-27	17750
Kuwait	-32	-35	51	-45	16562
Estonia		200	7	3	16400
Argentina	-46	21	-41	14	15502
Israel	-37	45	0	10	15150
Sri Lanka	1264	-67	25	740	10500
Ecuador	-40	183	-31	-13	10200
Serbia					10000
Uruguay	-48	-49	158	-5	9300
Switzerland		-99			8040
Nepal	-43	-99	3860	77	7010
El Salvador	-35	-27	-100	18600	6545
Kenya	-57	101	-36	-4	3940
Viet Nam	-4	40	-37	-10	4700
Mauritius	-46	-9	45	56	4550
Oman		700	-4	90	4374
Slovenia	100	-40	67	100	4000
Kenya	-57	101	-36	-4	3940
Bulgaria	-93	1334	-77	105	3700
Belarus	0	0	0	0	3425
Bolivia, Plurinational State of	0	0	0	-38	2800
Norway	0	0	1607	37	2800
Slovakia	0	0	0	0	2500
Tunisia	0	0	0	90	2000
Croatia	-86	100	710	-77	1855
Bahrain	1	-93	217	41	1340
Nigeria	0	0	0	0	1255

Importers	Exported growth in quantity between 2013-2014, %	Exported growth in quantity between 2014-2015, %	Exported growth in quantity between 2015-2016, %	Exported growth in quantity between 2016-2017, %	Exported quantity in 2017, Kilograms
Hong Kong, China	7	-60	87	22	1026
Jordan	-71	-60	50	-67	1000
Panama	0	0	100	-40	600
Greece	-36	22	-9	0	500
Iraq	567	0	0	-80	400
Tanzania, United Republic of	-38	133	-82	88	320
Uzbekistan	0	0	0	0	300
Bosnia and Herzegovina	0	0	0	0	250
Myanmar	0	0	0	0	200
Papua New Guinea	0	0	0	0	200
Brunei Darussalam	0	0	0	0	140
Maldives	0	0	0	117	130
Korea, Democratic People's Republic of	108	-60	30	0	0
Peru	22	0	0	0	0
Portugal	122	0	0	0	0
Yemen	224	0	0	0	0
Ukraine	0	0	105	0	0

Source: ITC: Trade Map: Trade statistics for international business development

For the FY 2013-2014 Export growth in quantity to United States of America was down by -12.67 %. Whereas it showed a positive result for the FY 14-15 & 15-16 as the export growth in quantity was up by 3.45 % & 5.5 % respectively. Subsequently export growth in quantity for the FY 16-17 was down by 7.57%.

Export to Germany showed a net growth in quantity by 30.41 % in FY 13-14, whereas for the FY 14-15 export was down by 3.18%. In succession it showed a positive result for the FY 15-16 & FY 16-17 as the export growth in quantity was up by 17.41% & 18.86 % respectively. Export to Italy showed growth in quantity by 20.46% in the FY 13-14, whereas for the FY 14-15 export was up by 38.59%. Subsequently export growth in quantity for the FY 15-16 was down by 1.26%, whereas export to Italy in the FY 16-17 was up by 23.04%. United Kingdom being the fourth largest importer of Psyllium husk from India showed a positive export growth in quantity by 4.14 % for the FY 13-14, whereas it showed a positive result for the FY 14-15 & 15-16 as the export growth in quantity was up by 36.41% & 26.83% respectively, whereas export to UK was down by 5.99% in the FY 16-17. In terms of quantity exported India's export to China stands at fifth position. China being the 5th largest importer of Psyllium Husk from India have shown consecutive positive results in terms of export growth in quantities. For the FY 13-14 export growth in quantity to China was up by 6.56% whereas export to china has shown significant increase year on year. For the FY 14-15,

FY 15-16 & FY 16-17 export to china has shown growth in quantity by 18.24%, 15.88% & 26.78% respectively.

1.6.1 Psyllium Husk Export Market

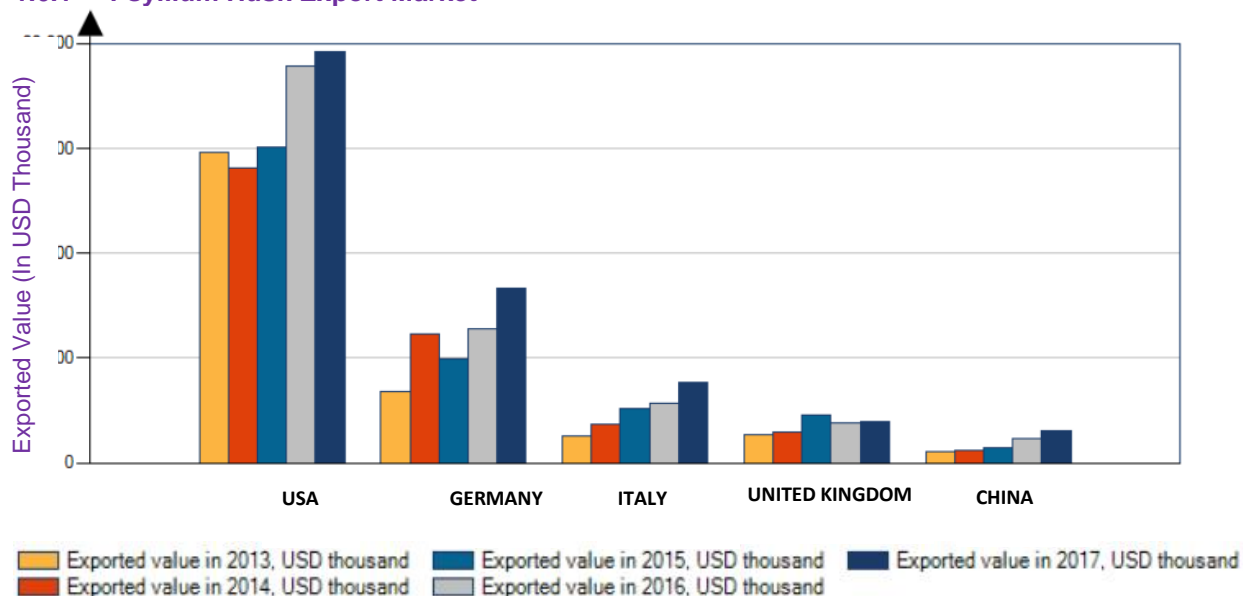


Figure 4:List of Export Markets for Isabgol Husk from India (HSN: 12119032): Exported Value

In terms of net export value: From the above figure it is evident that USA is the major export destination for India followed by Germany, Italy, United Kingdom & China.

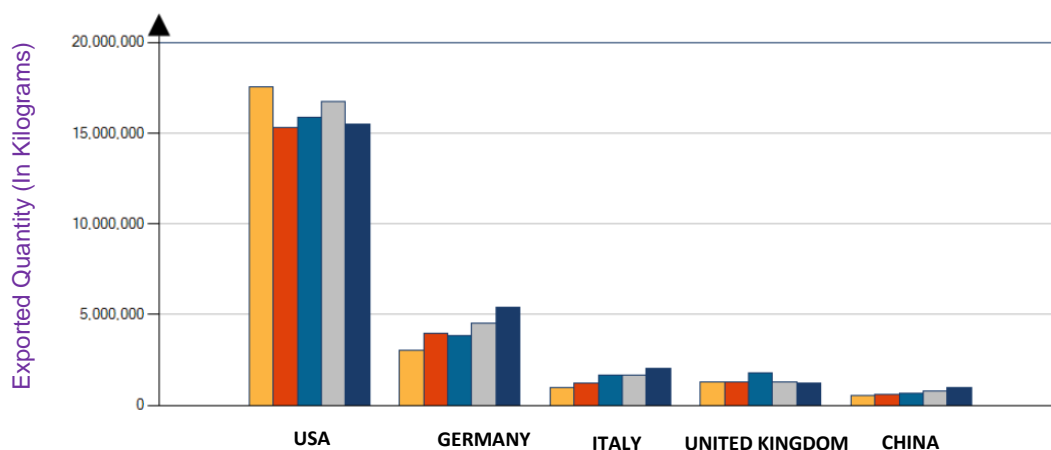


Figure 5:List of Export Markets for Isabgol Husk (HSN:12119032): Exported Quantity

From the above figure it's clear that in terms of exported quantities USA is the major market followed by Germany, Italy, United Kingdom & China.

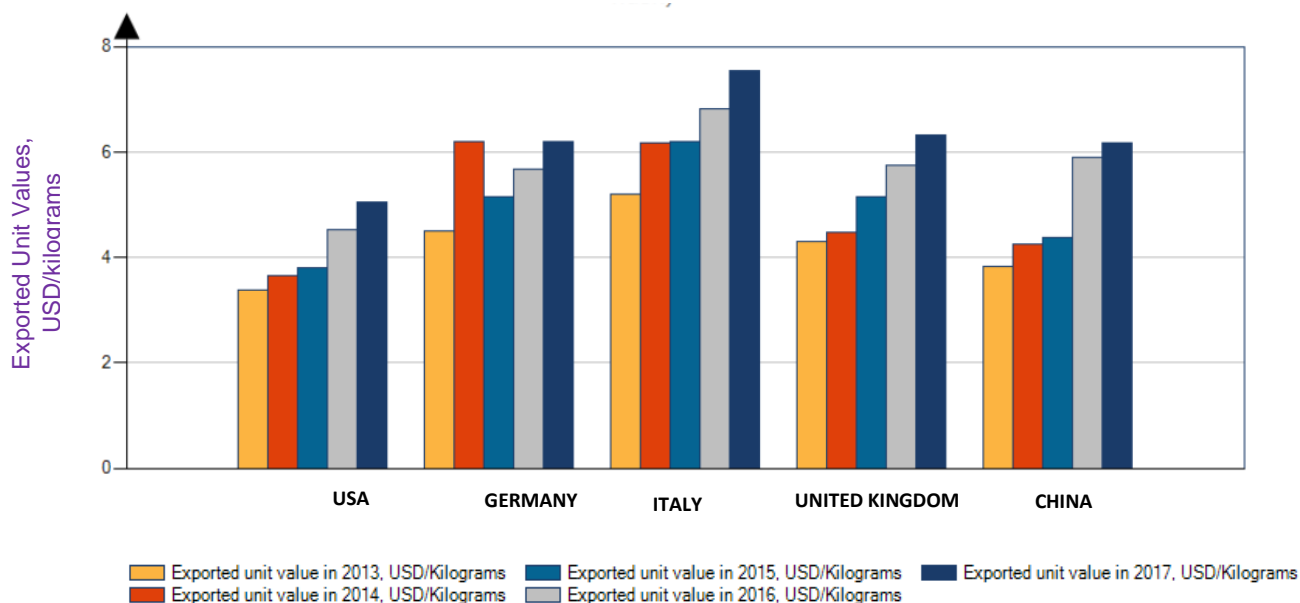


Figure 6:List of Export Markets for Isabgol Husk (HSN:12119032): USD/Kg

Below figure represents share in value in India's export. United States of America stands at number 1 with 37% Import share in India's export to the world. Germany stands at number 2 with 16% Import in India's export to the world. Italy stands at 3rd position with 7% share in India's export to world. United Kingdom at 4th Position with 4% share & China at 5th position with 3% share in India's export to world.

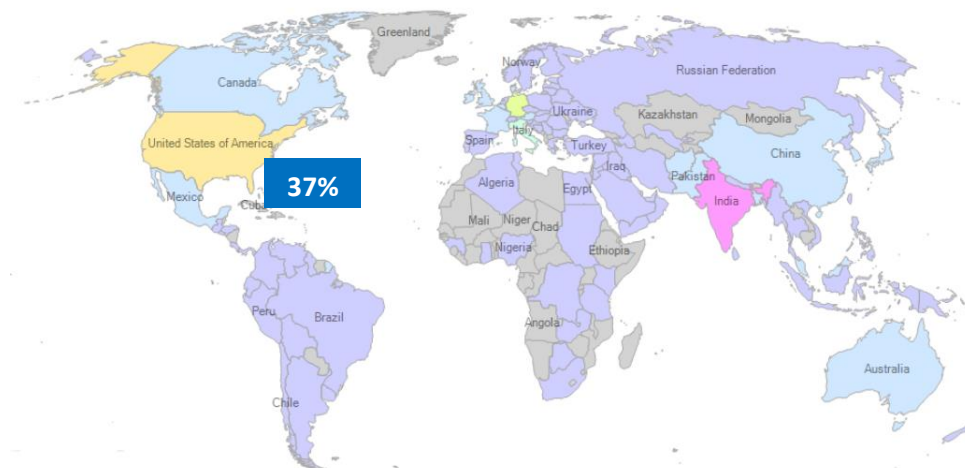
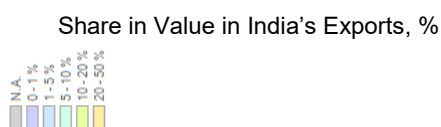


Figure 7:List of Importing Markets for Isabgol Husk from India (% Share in India's Export, In Value)



1.6.3 Isabgol husk Market: Segmentation

The psyllium husk market is segmented on the basis of origin, offering, and application. On the basis of origin, the psyllium husk market can be segmented into conventional and organic. The organic segment to witness high CAGR over the forecast period owing to the global trend of

organic and natural based supplements and nutraceuticals. The conventional segment is expected to dominate in terms of volume share owing to cost-effectiveness and low residue presence in the final product. On the basis of offering, the psyllium husk market can be segmented into whole, powder, and dust. The whole segment is expected to dominate the global psyllium market in terms of volume share. The powder segment is anticipated to see strong CAGR over the forecast period owing to its increased application in supplement and pharmaceutical market.

On the basis of application, the psyllium husk market can be segmented into dietary supplements, pharmaceutical, animal feed, and others. The dietary supplement segment is anticipated to dominate the global psyllium husk market owing to its high demand in the sector.

1.6.4 Isabgol husk Market: Patterns in Global Trade

North America is expected to dominate the global psyllium husk market over the forecast period resulted by the booming supplement market in the region and natural based pharmaceutical market in the region. The Asia Pacific to follow next which is attributed to its traditional use in the region as a remedy for problems occurring with digestive system. Europe to see significant growth for organic psyllium husk resulted by the regulation placed by the authorities for curbing out GMO and non-organic ingredients in supplements and pharmaceutical in the region. Latin America and the Middle East and Africa to post substantial volume consumption owing to the increasing aged population in the region.

Figure 8: Major buyers of Isabgol at Global level & buying trend





MOTHER LINES
USA

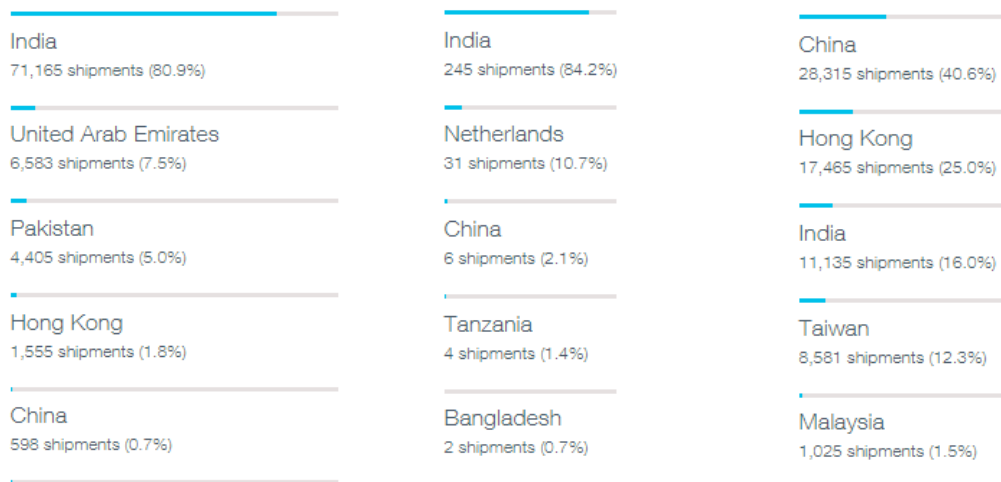


Figure 9: Major buyers of Isabgol at global level & buying trend

1.6.5 Isabgol husk Market: Drivers and Restraints

The psyllium husk market is expected to be driven by the increasing demand for natural remedies in OTC pharmaceutical segments as they are considered to be more beneficial and contents less side effects over synthetic offerings. Increasing working class population in developing region is aligned with the increasing laxative drug consumption due to sedentary lifestyle resulting in demand for psyllium husk over the regions. The aging population is susceptible to digestive problem which is attributed to fuel demand for psyllium husk in developed region with an aging population.

The psyllium market is expected to face restraint from other natural laxatives available in the market with added benefits and also from the synthetic laxative available at comparatively cheaper cost.

1.7 Isabgol products & its application

1.7.1 Isabgol Seeds

Psyllium seeds are an Agri-farm product of the dried ripe seeds of *Plantago ovata* forks (farm. Plantaginaceae) and it has been cleaned free of all dust, Agri farm fibers, wastes, mud, stones and iron particles. The seed itself is made up of 40% Linoleic Acid (LA), an important fatty acid essential to health.

Psyllium seed typically Light brown to moderate brown color and having faint odor. It contains about 70% soluble fiber and 30% insoluble fiber. It is made up of 40% Linoleic Acid (LA), an important fatty acid essential to health, 19% fiber content, 18.8% proteins, and 10-20% triglycerides. The seed mucilage consists of polysaccharides, which is a soluble fiber.

1.7.2 Isabgol Husk

The husk of Psyllium is the actual coating of mucilage around the seed. It is considered pure dietary fiber and are the only part of the plant used in manufacturing Psyllium products. Its nutritional value consists mainly of glycosides, proteins, polysaccharides, vitamin B1, and choline. Fiber content of over 80% compared to less than 15% for oat bran and 10% for bran. The husk is composed mostly of a fiber called hemicellulose which is a complex carbohydrate found in whole grains, fruits and vegetables. Hemicellulose is indigestible, however, it is partially broken down in the colon and feeds the friendly intestinal flora.

Psyllium seeds are processed to remove the outer coating of the seed to get the husk. Psyllium husk contains about 70% soluble fiber and 30% insoluble fiber. This white fibrous material is used in Pharmaceutical, cosmetics and food product industries. Psyllium husk is available in various grades according to the purity and mesh size etc. to match the individual user needs. It is available mostly in four grade of purity: 99% Pure, 98% Pure, 95% Pure and 85% Pure. Psyllium husk and psyllium seeds are graded according to the purity and quality of the material.

1.7.3 Isabgol Husk Powder

Psyllium husk powder is proceeded from the husk using pulverize machine using various particle mesh size. It is available mostly in four grade of purity: 99% Pure, 98% Pure, 95% Pure and 85% Pure.

1.7.4 Isabgol Applications

There are various application of Psyllium's and its products for Medical and industrial uses. In India, Psyllium has long been known for its healing properties and traditional uses. Psyllium remedies for constipation and many other ailments have existed since long back. Main use of Psyllium is in pharmaceutical formulations as a lubricating laxative, considered useful in the treatment of intestinal tract problems like constipation and other minor disorders.

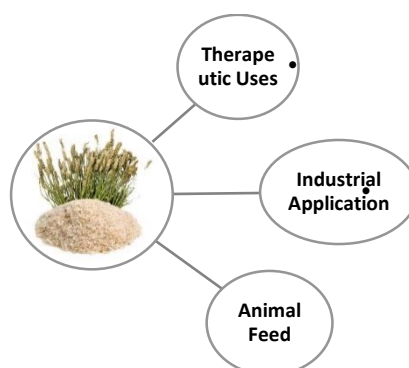


Figure 10: List of Importing Markets for Isabgol Husk from India (% Share in India's Export, In Value)

Psyllium is used in pharma industries for lowering of cholesterol. It has traditionally also been a major component of Indian medicinal herbs used in Ayurvedic and Allopathic preparations. It is known to soothe and protect inflamed cell membranes. Its anti-inflammatory activity is helpful with

gastric ulcers and its binding properties are useful with treatments for diarrhea, hemorrhoids and cystitis, Cystitis can sometimes be caused by fecal bacteria from diarrhea that migrates up to the urethra. It is useful during diarrhea because of its binding qualities and its ability to restore normal bowel movements. It can also relieve chronic constipation with habitual straining that can often lead to hemorrhoids. Intestinal spasms may be relieved by the anti-spasmodic property of Psyllium. It is known to soothe and protect inflamed cell membranes.

Psyllium Husk has no calories of digestible value and is therefore often used in slimming products as it makes one feel full without really providing nutrition. It is used in medical preparations in pharmaceutical. It is valued for its Nutraceuticals, Medicinal application. Western countries are the major users of it since the fiber content in their diet is usually very low.

Psyllium relieves constipation. Psyllium speed the passage of stool through the digestive tract by softening the stool and attracting water thereby producing more bulk, which stimulates the transit of waste through the gastrointestinal tract. Psyllium can be used as a bulk-forming agent to help relieve mild to moderate diarrhea. Psyllium soaks up a significant amount of water in the digestive tract, thereby making stool firmer and, under these circumstances, slower to pass.

- Soluble fibre psyllium husk has a cholesterol-lowering effect when added to a low-fat, low-cholesterol diet. Psyllium is quite effective in lowering total as well as LDL i.e. bad cholesterol - LDL levels, which can be helpful to those with high cholesterol and those at increased risk for developing hypercholesterolemia, such as people with type 2 diabetes.
- In a study of people with ulcerative colitis, a type of inflammatory bowel disorder, psyllium seeds were as effective as the prescription drug mesalamine in decreasing recurrences of the disease. In addition, a physician may recommend the use of psyllium as a bulking agent for mild to moderate cases of diarrhoea from either ulcerative colitis.
- Psyllium is use to prevent landscaping, soil erosion. In pharmaceutical industry, psyllium is used as thickening agent during capsule formulation.
- Psyllium can be used in food and beverages industry, in health drinks, beverages, ice cream, bread, biscuits, other bakery products, rice, cakes, jams, instant noodles, breakfast cereals etc., to improve the fibre content of the food and to increase the bulk of the food.
- Drinks or flavoured drinks to improve the mouth-feel of the drink and make it richer and impart good consistency to it.

Chapter 2- Manufacturing process and technology benchmarking

Husk is the main product of Isabgol. It is the outermost skin of the seed which is removed by mechanical process. Total recovery of husk is around 25 to 26 % from the seed. The price of husk depends on its purity and colour. Husk of 100% purity is sold at the highest price which is obtained after first milling of the seed and further husk is removed in the subsequent milling process where purity and colour gets diluted. In the market lowest grade is of 85 % purity and highest grade is of 100 % purity are quoted / traded at a definite price variance. Husk production can be estimated about 18,000- 19,000 MT, out of which 14,000- 15,000 MT is exported every year. The processing activities are mainly undertaken in Gujarat. During the processing the millers remove husk from the Isabgol seeds. This process is called de- husking.

The main by-products are:

- Lali: Used as cattle feed.
- Chito: Used as Pig feed.
- Khakha: It is used to prevent ice slipping
- Golaisab: Used as cattle feed



Figure 11:Isabgol Husk

2.1. Steps Involved in Manufacturing of Isabgol Husk

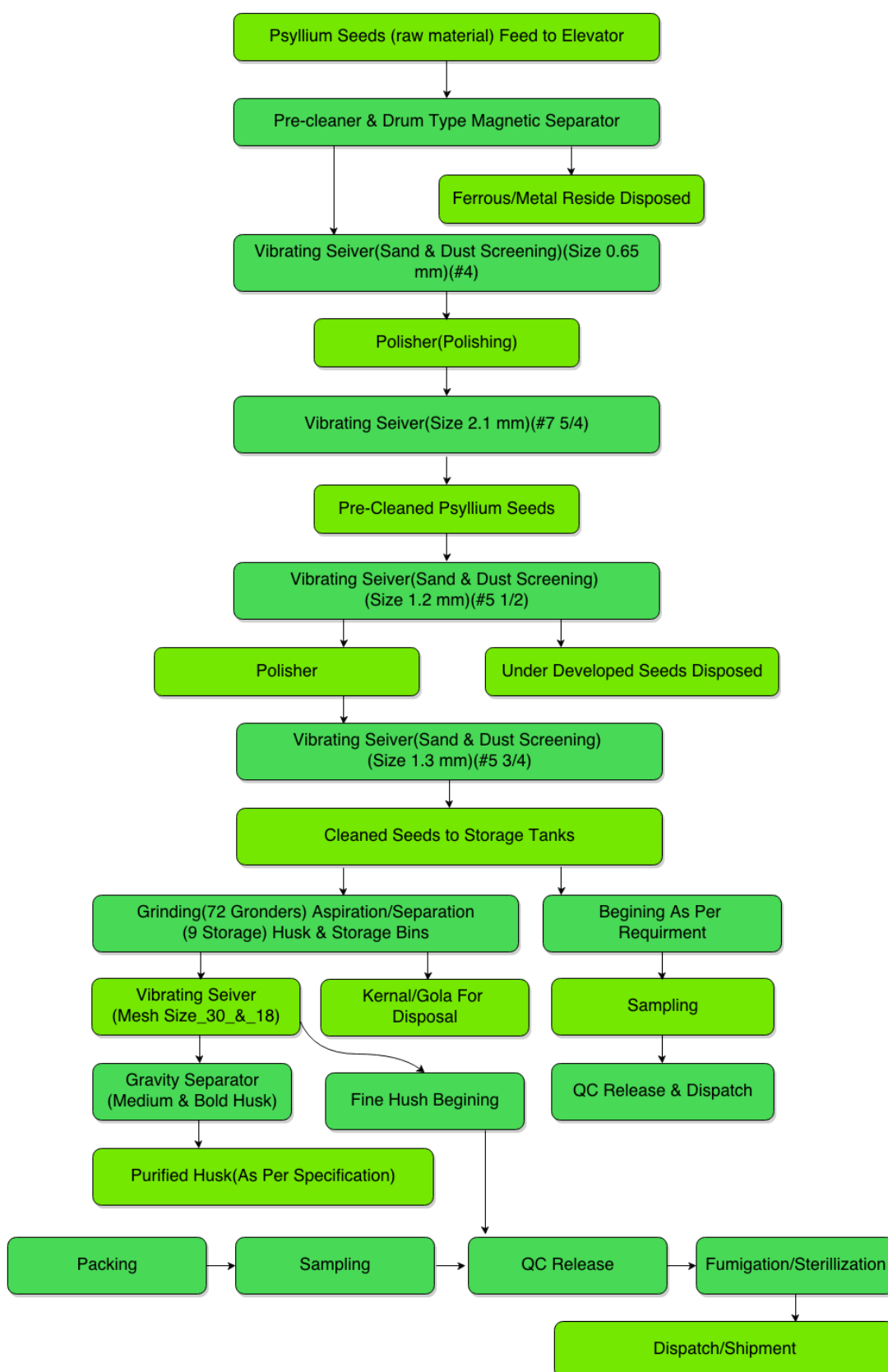


Figure 12:Isabgol Husk Manufacturing Process Flow Chart

- **Cleaning Section:**

The first step involved in the process is cleaning of Psyllium seeds. Once the Psyllium seed is received at Raw Material Reception deck it is weighted & then the raw psyllium seeds are cleaned by mechanical process through various steps of processing. Pre-cleaner is the first step, wherein the machine with diverse mesh size mesh separates the impurities in the Isabgol seed lot by size i.e. smaller than viz. dirt, dust, small round other crop seeds, etc. as well as those bigger than Isabgol seed viz. chaff, straw, other seeds, etc. A Vibro separator is also used in the further line of pre-cleaning to get maximum impurities and foreign material separated by size. In process of pre-cleaning, lighter than air impurities (dust, dirt etc.) are also cleaned through a system of air resistance using aspiration channel. The pre-cleaned Isabgol seed is now transferred to De-Stoner Machine through elevator where the stones of same sizes of Isabgol seed are separated by the principal of gravity classification which is connected with another aspiration line.

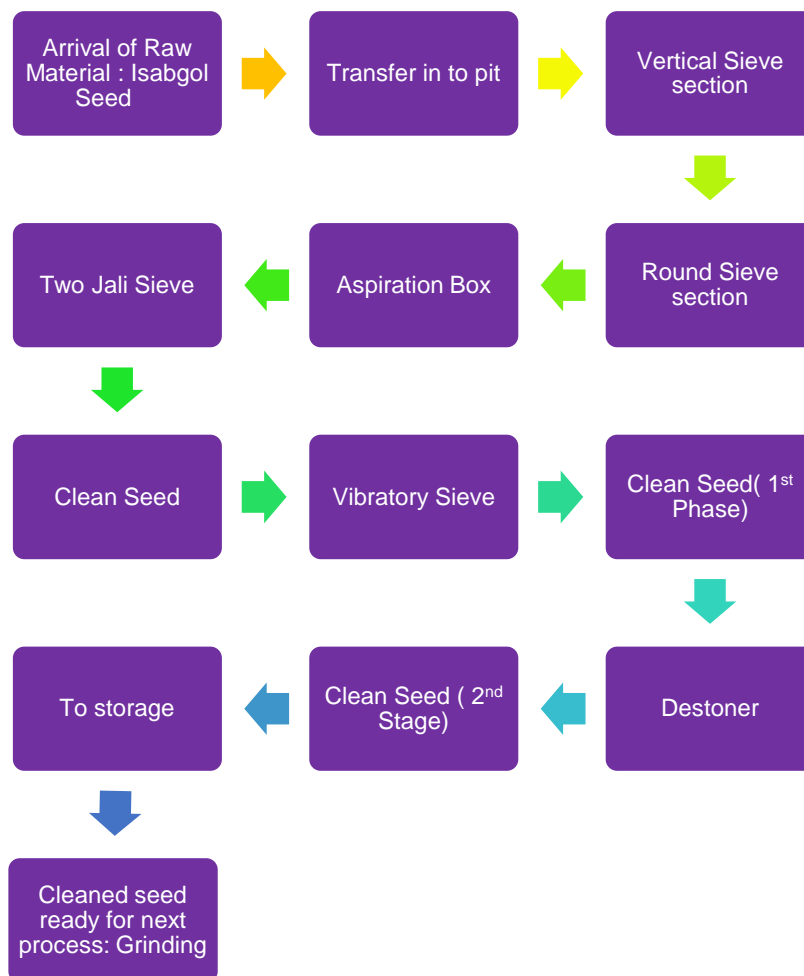


Figure 13:Isabgol seed Cleaning Process Chart

- Grinding Section:

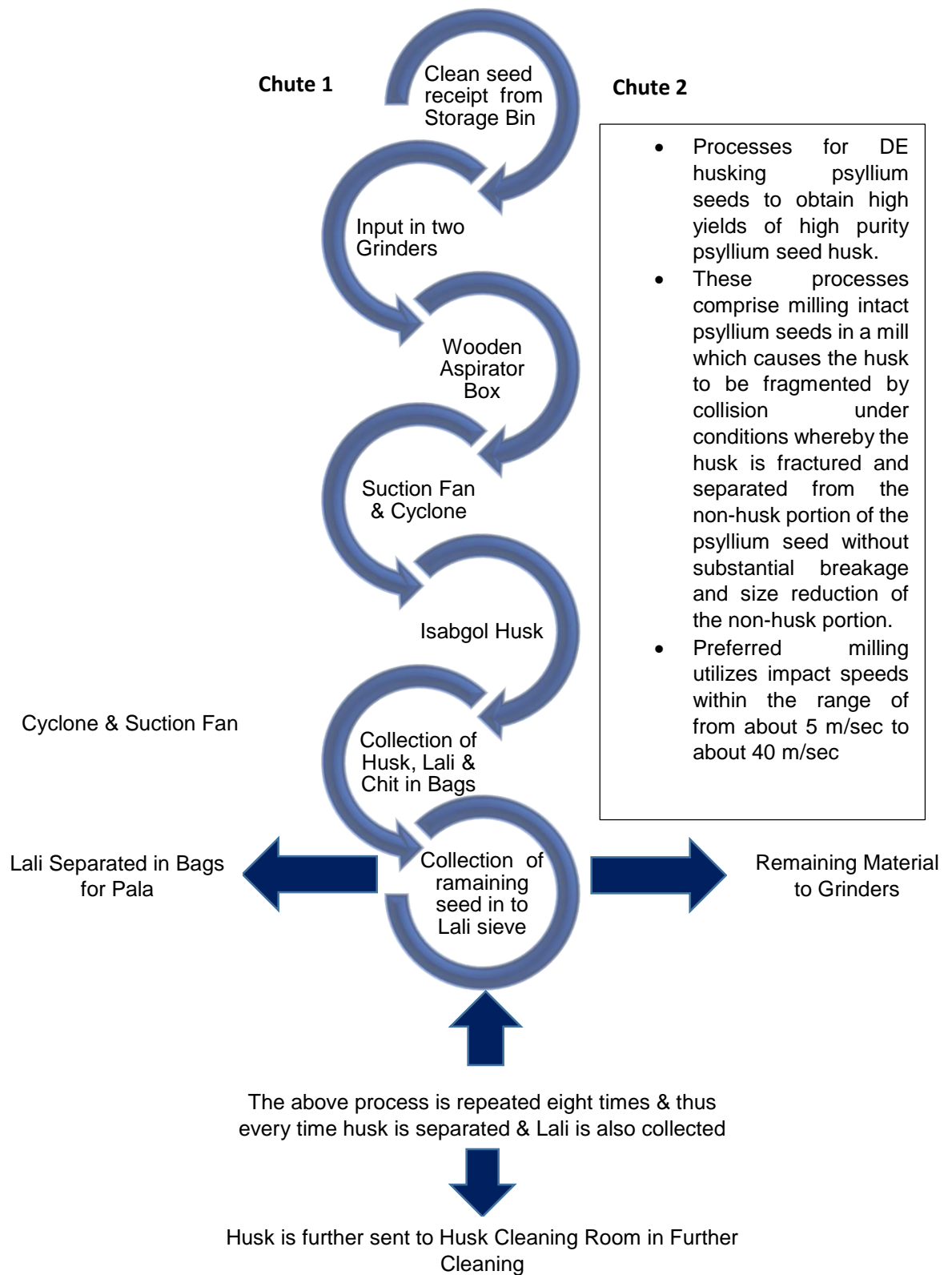


Figure 14:Isabgol seed Grinding Process Chart

- **Husk Cleaning Section:**

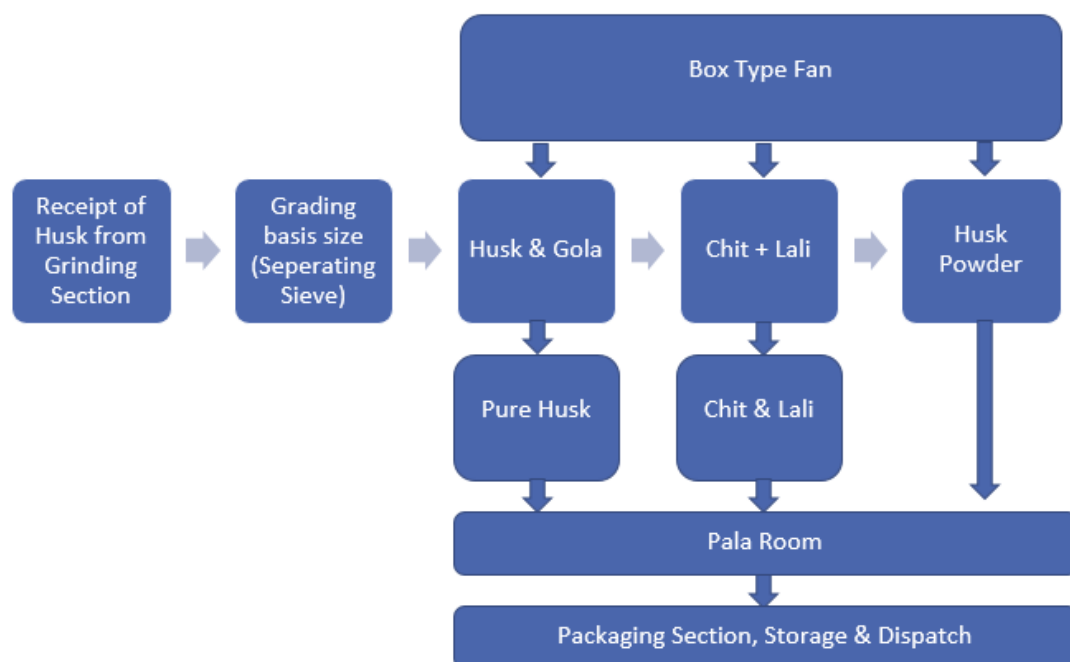


Figure 15: Isabgol Husk Cleaning Unit & Packing Process Chart

In the above process of cleaning, a system of aspiration using medium pressure fan is used by allowing pipe/ducting connections to the various machines. The main function of this system is to separate lighter impurities from (including those generated in process). All the vertical conveying process is facilitated through use of elevators and the horizontal conveying is done by use of worm conveyors. Magnets are installed in between few lines in order to separate the ferrous particles present with the Isabgol seeds.

- **Isabgol Husk & it's by products:**

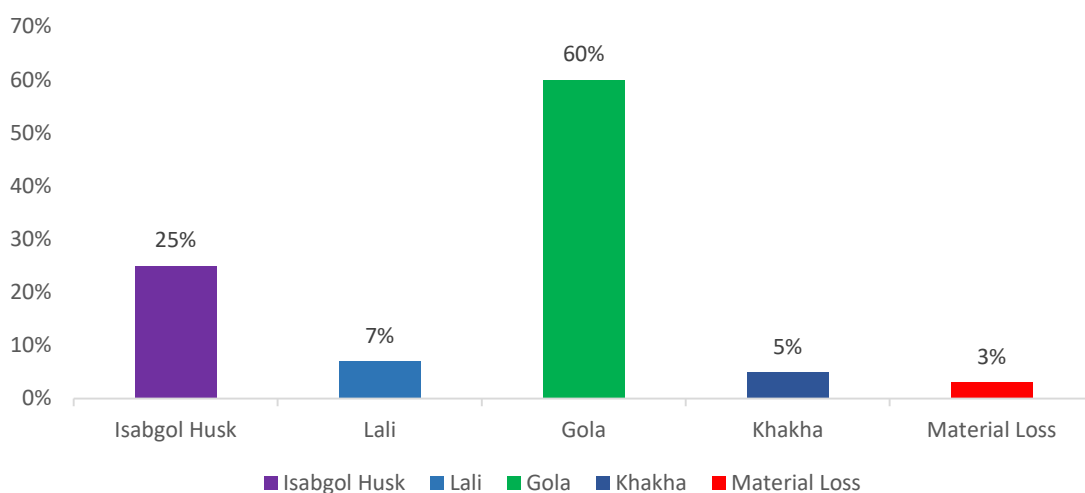


Figure 16: Production of Husk & By Products from 1 Kg Isabgol Seed

- **Product Description as per USP Specifications:**

Table 5: Isabgol Husk Description as per USP Specification

DESCRIPTION	PSYLLIUM HUSK 85%	PSYLLIUM HUSK 85%	PSYLLIUM HUSK 98%	PSYLLIUM HUSK 99%
Description	Plantago Ovata Frosk Husk. The Odour is not Marked	Plantago Ovata Frosk Husk. The Odour is not Marked	Plantago Ovata Frosk Husk. The Odour is not Marked	Plantago Ovata Frosk Husk. The Odour is not Marked
Odour	Faint Characteristic s Odour - Husk-like	Faint Characteristic s Odour - Husk-like	Faint Characteristic s Odour - Husk-like	Faint Characteristic s Odour - Husk-like
Sieve Test	As per Customer requirements	As per Customer requirements	As per Customer requirements	As per Customer requirements
Taste	Blend Mucilaginous	Blend Mucilaginous	Blend Mucilaginous	Blend Mucilaginous
Moisture	12% Maximum	12% Maximum	12% Maximum	12% Maximum
Protein	3.0 % Max	3.0 % Max	2.0 % Max	2.0 % Max
Swell Volume	Not less than 35 ml/gm	Not less than 40 ml/gm	Not less than 45 ml/gm	Not less than 50 ml/gm
Total Ash	4% Maximum	4% Maximum	4% Maximum	4% Maximum
Acid Insoluble Ash	1% Maximum	1% Maximum	1% Maximum	1% Maximum
Heavy Extraneous Matter	1.0% Maximum	1.0% Maximum	0.5% Maximum	0.5% Maximum
Light Extraneous Matter	15% Maximum	5% Maximum	2% Maximum	1% Maximum
E-coli	Negative	Negative	Negative	Negative
Salmonella	Negative	Negative	Negative	Negative
Yeast & Mould Count	< 1000 per gram	< 1000 per gram	< 1000 per gram	< 1000 per gram
Insect Infestation	Not more than 100 insect fragments including mites and psocides per 25 grams	Not more than 100 insect fragments including mites and psocides per 25 grams	Not more than 100 insect fragments including mites and psocides per 25 grams	Not more than 100 insect fragments including mites and psocides per 25 grams

Packaging: Isabgol seeds have the longer shelf- life. The seeds are dry & can be stored for 8-10 years. The seeds are kept in simple gunny bags with or without plastic lining. The raw Isabgol is kept in the simple gunny bags of 75 kg per bag.

Isabgol husk are highly sensitive to environmental parameters. To enhance the shelf life, it should not be exposed to moisture and air and hence packed in plastic coated jute bags. However, it can also be packed in paper bags, synthetic bag, drum packs with plastic coating. Husk cannot be stored for a longer period as it starts losing colour and also there is a change in fiber content because of growth of bacteria. Isabgol's shelf life remains only for 6 months in ordinary and traditional storage conditions. It is packed in the airtight plastic coated bags in order to prevent it from the atmospheric humidity. Moreover, while storing enough care is taken from pest attack. It

is stored on wooden pallets and is kept at least two feet away from wall in order to prevent it from moisture. Fumigation on regular interval is done to preserve it for longer period of time.



Figure 17: Isabgol Husk Bulk packing in Gunny Bags & Consumer Packing

Quality Control: The products should be in conformity with CGMP (current good manufacturing procedures), SSOP (sanitary standard operating procedures), HACCP and ISO standards.

CGMP: CGMP refers to the Current Good Manufacturing Practice regulations enforced by the FDA. CGMPs provide for systems that assure proper design, monitoring, and control of manufacturing processes and facilities. Adherence to the CGMP regulations assures the identity, strength, quality, and purity of drug products by requiring that manufacturers of medications adequately control manufacturing operations. This includes establishing strong quality management systems, obtaining appropriate quality raw materials, establishing robust operating procedures, detecting and investigating product quality deviations, and maintaining reliable testing laboratories. This formal system of controls at a pharmaceutical company, if adequately put into practice, helps to prevent instances of contamination, mix-ups, deviations, failures, and errors. This assures that drug products meet their quality standards.

The CGMP requirements were established to be flexible in order to allow each manufacturer to decide individually how to best implement the necessary controls by using scientifically sound design, processing methods, and testing procedures. The flexibility in these regulations allows companies to use modern technologies and innovative approaches to achieve higher quality through continual improvement. Accordingly, the "C" in CGMP stands for "current," requiring companies to use technologies and systems that are up-to-date in order to comply with the regulations. Systems and equipment that may have been "top-of-the-line" to prevent contamination, mix-ups, and errors 10 or 20 years ago may be less than adequate by today's standards.

It is important to note that CGMPs are minimum requirements. Many pharmaceutical manufacturers are already implementing comprehensive, modern quality systems and risk management approaches that exceed these minimum standards.

The scientific testing of random samples should be carried out at every intermediate stage of processing. Only after getting approval from the Quality Assurance department the intermediate

products should be used for further processing and final packaging. For processing, the material should be selected on the principle of first in, first out [FIFO]. The stringent care and hygienic conditions that are maintained throughout the processing period, and the fumigation (as per direction pest control of India) conducted before packing the material cannot be contaminated.

SSOP (sanitary standard operating procedures): Sanitation Standard Operating Procedures is the common name given to the sanitation procedures in food production plants which are required by the Food Safety and Inspection Service of the USDA and regulated by 9 CFR part 416 in conjunction with 21 CFR part 178.1010. It is considered one of the prerequisite programs of HACCP

SOPs are generally documented steps that must be followed to ensure adequate cleaning of product contact and non-product surfaces. These cleaning procedures must be detailed enough to make certain that adulteration of product will not occur. All HACCP plans require SSOPs to be documented and reviewed periodically to incorporate changes to the physical plant. This reviewing procedure can take on many forms, from annual formal reviews to random reviews, but any review should be done by "responsible educated management". As these procedures can make their way into the public record if there are serious failures, they might be looked at as public documents because they are required by the government. SSOPs, in conjunction with the Master Sanitation Schedule and Pre-Operational Inspection Program, form the entire sanitation operational guidelines for food-related processing and one of the primary backbones of all food industry HACCP plans.

SSOPs can be very simple to extremely intricate depending on the focus. Food industry equipment should be constructed of sanitary design; however, some automated processing equipment by necessity is difficult to clean. An individual SSOP should include:

- The equipment or affected area to be cleaned should be identified by common name
- Tools necessary to prepare the equipment or area to be cleaned
- Procedures for dismantling the area or equipment.
- Method of cleaning and sanitizing

HACCP: HACCP Stands for Hazard Analysis and Critical Control Point. HACCP is an internationally recognized system for reducing the risk of safety hazards in food.

A HACCP System requires that potential hazards are identified and controlled at specific points in the process. This includes biological, chemical or physical hazards. Any company involved in the manufacturing, processing or handling of food products can use HACCP to minimize or eliminate food safety hazards in their product.

Awareness of food-borne illness is increasing and concern throughout the industry is driving the use of HACCP and HACCP based certification program



Figure 18: Principles of HACCP

- **Conduct a Hazard Analysis:** The hazard identification is done in two steps, first the identification of hazards, then an evaluation of the hazard. The hazard evaluation is a determination of the degree of risk to the user from the identified hazard. Once the hazard is identified and evaluated the team must identify critical control points. These are points where the hazard must be controlled or it will present a risk to the end user.
- **Identify the Critical Control Points:** Establish a maximum or minimum limit for temperature, time, pH, salt level, chlorine level or other processing characteristic that will control the hazard. This is the critical limit for the CCP. If this limit is ever exceeded corrective action must be taken, and all affected product controlled.
- **Establish Critical Limits:** Next step is to establish criteria for each critical control point. What criteria must be met to control the hazard at that point.
- **Establish Monitoring Procedures:** The monitoring that takes place at the critical control points is essential to the effectiveness of the HACCP program. The monitoring program will be made up of physical measurement or observations that can be done in a timely manner, to provide the information in a time frame that allows you to take action and control product if an out of control situation occurs.

- **Establish Corrective Actions:** The action must make sure that no unsafe product is released. There must also be an evaluation of the process to determine the cause of the problem and an elimination of the cause.
- **Establish record keeping:** Determination of what records are needed to show that the critical limits have been met, and the system is in control. Address regulatory requirements and include records from the development of the system and the operation of the system.
- **Establish the verification procedures.** The HACCP plan must be validated. Once the plan is in place, make sure it is effective in preventing the hazards identified. Test the end product, verify that the controls are working as planned.

2.2. Benchmarking the Isabgol husk Manufacturing process

Majority of Isabgol husk manufactures are based out of Unjha, Gujarat whereas in Rajasthan very few manufacturers are present primarily in Jodhpur & Ckaksu near Jaipur.

Many of these firms constitute high capital intensive units that have constantly pursued technology upgrading and established automatic plants procured from world leaders in equipment and technology such as Buhler/Satake/Fowler Westrup/Krishna Industries/ Cymbria. Even in terms of micro and mini units some of these technologies can be easily incorporated to realize better yields and desired quality output.

Some of the advanced Manufacturing unit in Rajasthan (as well as other regions of the country) have deployed these machines, yet there is a scope for adoption of current technology.

Table 6: To summarize, the process of Isabgol Husk making involves various activities which may be benchmarked in terms of best practices

Sr. No.	Process	Old method (especially in micro units)	Modern Method/s in more advanced units
1	Raw Material Storage	Storage of raw material by Manufacturers in own or other private godowns leaves the raw material subject to infestation by rodents and pests. Modern and scientific warehousing systems like dehumidifiers, temperature monitors, seed handling equipment, etc. are non-existent in such facilities. Often, lack of hygiene, pilferages, leakages, improper handling of material, and various other factors lead to losses in storage.	Modern technology involves raw material storage in silos made of galvanized steel re-enforced exteriors. Galvanized Silos are used for storage of grains in bulk for longer periods. These silos are made in Galvanized Steel and bolted in construction. The main parts of the silos are made in corrugated sheets instead of plain sheet, which increases its strength. These silos are generally equipped with accessories like Level Switches, Aeration System, Temperature Monitoring, Ventilation and Sweep Augers. These accessories help us to monitor the quality of stored grain inside the silos. Galvanized Silo Storage System is also a proven scientific system for storage of

			and other food grains in Europe and America. This system ensures zero wastage due to moisture, fungus & rodents etc. This also enables units to target premium markets from quality-seeking consumers through direct retailing and export. In India, this system is adopted to some extent by private sector. Fowler Westrup, Rostfrie Steels, Westeel Silos, Buhler, Milltec, Bansal Group etc. are some key supplier options of large silo storage systems.
2.	Raw Material Cleaning (Pre-cleaning and Fine Cleaning)	<p>Most manufacturers use inadequate pre-cleaning and fine cleaning equipment and facilities.</p> <p>The use of equipment like fine cleaners, magnetic separators, color sorter is limited to high capital intensive. Many use some outdated fabricated cleaning machines, which leads to losses in yield since such machines (on several occasions) have low throughput capacities. Additionally, cleaning may not be efficient with low accuracy in removing foreign materials, immature grains, ferrous impurities, other crop grains, broken, color defects and infected seeds.</p> <p>As a matter of fact, improper cleaning reduces the price realization for processors as well increases the danger of clogging of downstream machines and thus increasing repairs and maintenance costs and may also lead to reduced life span of the machines.</p>	<p>To the contrary, benchmarked cleaning equipment deployed in larger firms based in Unjha Gujarat & Chaksu – Jaipur involves a complete cleaning line including</p> <ul style="list-style-type: none"> • Pre-Cleaner (Drum Sieve): Careful preliminary cleaning of grain reduces the wear and tear on the downstream equipment in the production process. This enhances the operating reliability of the entire production plant. A Buhler/Fowler Westrup/Cymbria/similar top end technology reliably remove straw fragments, bag tapes, paper, pieces of wood, etc. from fine and coarse-grained bulk materials & other foreign matter. • Magnet Separator: A Buhler/Fowler Westrup/Cymbria/similar top end technology make magnetic separator that is designed to efficiently remove ferrous items from material streams. Self-cleaning mechanism of these separators ensures smooth operations (also avoiding slowdown or breakdown) by avoiding clogging. • Separator Classifier: A Buhler/Fowler Westrup/Cymbria/similar top end technology make is applied for . Using sieves, the separator removes coarse and fine impurities from the

			<p>Seed. It also grades a wide range of different materials according to size.</p> <ul style="list-style-type: none"> • Gravity Separator: A Gravity Separator is used for the separation of any kind of kernel and granular product of almost identical size but with different weights. A Buhler/Fowler Westrup/Cymbria/similar top end technology make reliably removes immature grains and other impurities on basis of weight and facilitate grading of Isabgol Seeds. • De-Stoner: A Buhler/Fowler Westrup / Cymbria/similar top end technology make effectively removes even small and lighter-weight stones of the size of a grain kernel from the stream of product, thus ensuring excellent cleaning of the grain. Removal of high-density impurities such as stones, glass, and metal protects the downstream processing equipment and thus perceptibly reduces its wear and tear. • Color Sorter: An efficient color sorter uses a combination of most advanced camera and shape recognition identifier to ensure detection and removal of the widest range of foreign materials, smallest spot defect, finer product damage and subtler color defects. Importantly, removal of mycotoxins (produced by fungus) on Isabgol seed is also detected which ensures safety and quality of finished flour. Advanced units generally deploy advanced sorters of Buhler/Satake/Milltec/Cymbria make for optimum results. <p>In a nutshell, applying these new innovations in the cleaning process produces a better quality, safer, more consistent finished product for the</p>
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			customer. This results in improving the profitability and image of the industry at a time when product purity and food safety standards are of the utmost importance.
3.	De-Husking Section	<p>Manual Roll: Several small scale (roller flour) millers in this segment still use outdated manual rollers (single/double), which reduces efficiencies and also hinders capacity upscale. In general, old plants generally have four-roller body mill, whereas most modern mills have upgraded to 8 roller body mill.</p> <p>Stone Chakki: Few of the major drawbacks of traditional chakkis (consisting of 2 dressed stone discs (one stationary, other rotating)) at Rajasthan include stone shavings getting mixed in flour and bran, high operational & maintenance cost (due to high abrasion), high energy / low throughput, difficulty in maintaining consistent control quality, and higher foot print requirement.</p>	<p>In comparison, technology and equipment in some modern units at Gujarat & Rajasthan, as well other key locations considerably address the gaps associated with the traditional systems. The milling section with benchmarked technologies comprises of:</p> <ul style="list-style-type: none"> • Modern Roller De-Husking Unit: Modern Rolls are constructed with non-corrosive material and full accessibility to ensure maximum sanitation. In general, 36 rollers are deployed which grinds the product. The main reason for using 36 rollers is improved economics, as it reduces the need for intermediate transport of product. The overdrive system of machine is equipped with conveyor belts that eliminate the need for oil, which is generally the case for helical gears in traditional roller models.
4.	Wholesale and Retail Packaging	<ul style="list-style-type: none"> • Wholesale Bagging: Most units in the region use gunny bags as packaging material sourced through local dealers and agents from manufacturers in locations like the Hyderabad, Gujarat, National Capital Region (NCR), etc. Firms mostly pack Isabgol husk in 50 KG and 75 KG 7 100 Kg bags. The packaging operations are largely tedious, time consuming and manual. After filling and weighing the bags manually, a basic 	<ul style="list-style-type: none"> • Wholesale Packaging of products and by-products is done through an Automatic Weighing and Bagging machine, which can pack the flour in 10 kg-100 kg capacity bags. In general, 25 kg and 50 kg size bags are used in wholesale. On an average, such bagging machine can give an output of 250 to even 500 bags per hour. • For retail packaging (i.e. 100 Grams, 250 Grams, & ½ kg, a vertical form fill seal (VFFS) machine is used. In both types of packaging, an augur filler type filling system is required. It is a filling mechanism which measures

		<p>hand held stitching equipment is used. Benchmarked machine and equipment for same involves automatic net weighing and bagging system.</p> <ul style="list-style-type: none"> • Retail Packaging: Most units in the region get job work done from service providers for retail packs like 100 Grams & 250 Grams. Some manufacturers use manual filling methods with simple heat sealing machines. Benchmarked machine and equipment for same involves Form-Fill-Seal machines, which is deployed in some big scale roller flour mill units Unjha: Gujarat & Chaksu : Rajasthan. 	<p>out a product, usually powder or free flowing solids, using an auger which is rotated for a predetermined number of revolutions in a conical hopper to discharge the required volume of product. The main benefit of these machines is their ability to control dust during the filling operation and are therefore are used extensively for powders and dusty free flowing solids. To compensate for changes in the bulk density of the product, auger filler is frequently used in conjunction with a weighing instrument like a check-weigher. Fillers of this type are suitable for filling products at both low and medium speeds.</p> <p>Some reputed suppliers like Hassia Packaging, Nichrome, Husk international etc. could be considered for machinery selection.</p>
5.	Testing and other support activities	<p>Most manufacturers in Rajasthan have some basic testing units for in-house quality check and control. This is primarily because of the fact that material is required to be tested at several stages of processing. However, on several occasions, even such units are required to outsource various tests from local as well as distant accredited testing labs. The lead time in some basic/key tests could range from couple of days is to over a week.</p>	<ul style="list-style-type: none"> • Testing equipment comprising Digital and IR Moisture Meter, hot air oven, ashing oven/muffle furnace, kjeldhal apparatus, soxhlet apparatus, centrifuge, vortex stirrer, sedimentation shaker, NIR grain analyzer, Universal lab sifter, pH meter, precision weighing scales, glassware and chemicals, etc could be required by miller unit as per requirements. • Some key tests like Moisture test (air oven method and IR), Ash test, Acid content in soluble ash, Sedimentation value, Water absorption test, Color test, CCL4 test, Alcoholic acidity test, baking tests, granulation tests, etc may be conducted at shop floor for effective quality control. <p>Dealers of some reputed manufacturers like Agilent and Presto Testing could be considered for testing equipment.</p>

6.	Support Equipment, Engineering and Automation	<ul style="list-style-type: none"> The support system majorly includes material handling equipment (elevators, conveyors, etc.), aspiration system (aspirators, cyclone, airlock, fans, aspiration line and ducting, etc.), hoppers and storage bins, the machine support structure, other mechanical fabricated equipment and other support equipment (compressor, etc.). The quality of these equipment's is highly critical for overall performance of the Plant. However, in this context many manufacturers have sub-standard quality system which leads to dusty environment, leakages, clogging and breakdowns and other related problems. 	<ul style="list-style-type: none"> The support structure and equipment play a highly important role in the performance of the manufactured products. Based on size, capacity and engineering, the support structure and equipment need to be installed. Since several machines function on vibration principle, it is highly important that the support structure is robust and shock absorbent. Key suppliers like Buhler, Bansal Group, Choyal, Fowler Westrup, etc also supply turnkey solutions in this context. Few other domestic options include Aqua Engineering (Gujarat), Osaw Agro (Ambala), etc. Compressors of Atlas Copco, Krishna industries, ELGI or of similar reputed make are highly preferred by manufacturers to support color sorting and packaging operations and to support other pneumatic function. The design decisions have a tremendous impact on operational sanitation and maintenance. The plant layout should present a smooth, orderly flow of raw materials or ingredients through each manufacturing phase on to the storage of the finished product. All processes in the manufacturing unit can be optimized and controlled through control panel i.e. automation. Process optimization refers to operate plant optimally with economic performance in terms of productivity and yields. It also avoids human errors. Key turnkey plant suppliers like Buhler, Bansal Group, Choyal, Fowler Westrup, etc. provide solutions on this front as well.
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Chapter 3- Appropriate Technology Option

3.1 Silo Storage Facility

Poor storage facility leads to infestation by pests depending on various factors like moisture content of seed, relative humidity, temperature, storage, structures, fumigation frequency etc. Silos play a critical role in this context and may be considered as an essential part of a pre-cleaning line.

The silo system for Isabgol seed should ideally be built or configured according to DIN 1055



Storage silos

standards made in galvanized steel of 450 GSM (grammas per cm square ft. size coating). Galvanized steel of 450 GSM will ensure longer life span of even 15-20 years of silos. Quality of raw material stored in silos is stored in bulk directly in silos without use of gunny bags. This ensures reduced loss due to rodents, wastage etc.

Typically, a 50 MT capacity silo comes with diameter of about 3.82 meters with height of over 11.03 meters and capacity of about 82.13 cu. meters. This volume can hold of 50 MT based on bulk density @ 600 kg/ m³ and 3% compaction. The silo comprises of shallow corrugated panels, galvanized outside stiffeners made from high tensile steel, hopper supporting and leg structure hot dipped galvanized protection, vertical and roof ladder.

Silo accessories include sensors, that is, vibratory fork type high and low level indicators provided for indicating the high and low levels of grain in a silo and discharge gates in terms of manually operated screw type discharge gates provided in the bottom of the silo for controlling the flow of grain. In addition, accessories include catwalks, goal post and silo cap support (for supporting the overhead chain conveyor), receiving hopper, bucket elevator, supporting structure for elevator and holding bin for cleaner; cyclone, rotary air lock, chain conveyors made of GI steel; transfer chutes, ducting, spouts and waste product chutes. Equipment suppliers such as Fowler Westrup India Pvt. Ltd., Rostfrie Steels, Westeel Silos, Buhler Group, Milltec Machinery, Bansal Group etc. have an established reputation in the field of galvanized silos.

3.2 Pre-cleaning, Main Cleaning Line & Processing line

Major goal of Isabgol seed cleaning is to remove non-Isabgol seed material (like metal, foreign material (debris), stones, grains other than Isabgol seed (i.e. shrunken & broken or diseased & damaged)). This is highly important to ensure the premium quality of final products- i.e. Isabgol Husk, Its byproducts etc. Efficient cleaning ensures decreased infestation risks, improved sanitation and dust control and decreased microbial growth. It also improves flow of Isabgol seeds through the bins. An efficient material movement in aspiration system is equally important to get quality output.



Impurities in Isabgol are separated based on some physical differences which aid their removal. These differences primarily include magnetic properties, size and shape, density, friability (easily broken by impact) and surface characteristics (color and texture). **Below are the machines that enable removal of such impurities on basis of their properties:**

Drum Sieve: A quality drum sieve machine is used for removing large impurities from Isabgol at high capacities. Careful preliminary cleaning of Isabgol reduces the wear and tear on the downstream equipment in the production process.

It is effective at removing rocks, stones, string, paper, timber, product lumps and other large impurities. Isabgol is transferred in the drum sieve through the inlet spout which conveys it into the perforated screen drum. The screen rotates agitating the material and allowing the good product to fall through the screen.

Oversize material is conveyed to the outlet, assisted by the conveying spiral in the second screen section, and exits through the oversize product spout. The capacity of the Drum Sieve is dependent on the nature of the raw material and the contaminants to be removed and screen sizes are selected to suit the application. Screens are kept clean by a heavy duty brush.

Magnetic Separator:



Magnets to remove ferrous metals should be installed at numerous places in every cleaning section. It is advisable to have a magnet located at the beginning of the cleaning section to remove metal and thus reduce the risk of a dust explosion before the grain stream passes the main machines in the cleaning section. Magnetic separators are employed for the removal of metal particles, e.g. nails, wire and screws.

The reliable separating effect of an efficient magnetic separator guarantees the highest level of product, process safety and eliminates metal particles from the material being processed. Another advantage resulting from

such superior separation is that potential machine wear during subsequent processing steps is significantly reduced.

Gravity Separator: An efficient gravity separator will remove foreign seeds from that cannot be removed by any other method.



It also removes mud and other inert matter as well as broken & shriveled. Through an efficient gravity separator, weight differences of as little as 1% can be detected and separated and particle sizes ranging from 200 microns to 15 millimeters can be processed. With use of efficient conceived air distribution, the material being fed through can be precisely separated into three fractions according to specific gravity; i.e. high-density (heavy), mixed, and low-density fractions. This provides accurate controlled separation of any type of product in

flow-able, granular form removing impurities and unwanted foreign material, or upgrading and classifying the product



De-Stoner: This machine is applied for the efficient separation of stones and metal, glass, and other high-density impurities from a stream of grain. An efficient machine ensures a mud-ball less and stone-less output. Quality machine also ensures that there will be negligible loss of and a process of self-cleaning system for maximum operating efficiency.¹

Machine Principle: Gravity-fed grain is spread by a feeder, which also acts as an air seal, across the entire width of the machine. On the perspiration

screen, the product stream is stratified by the oscillating motion of the screen and the air flowing through the product from bottom to top according to its specific gravity. The lighter particles float at the top, while the heavy particles, including stones, settle to the bottom of the product stream. The heavy particles flow upward and are fed to the final separation zone of the bottom destoning screen. Final separation of the stones from the grain is accomplished by a countercurrent of air. The stone-free grain floats on cushions of air toward the product outlet. Discharge occurs through rubber squeeze valves

Color Sorter: Post the above cleaning process, colour sorting is required for separating unwanted contamination and foreign material from good material based on colour and type. In the color sorting process, to be sorted is fed into the hopper located on a vibrating plate.



The plate then spreads it and carries it through slanting sections, where it is further separated. The product then falls through an analysis section where each particle is checked by two optical devices facing each other. The characteristic electrical signal for each color is conveyed to a control unit which converts this signal, should non-designated particles be present; these are shut-off to the discard bin by means of an air burst fired by ejectors. Product considered good is instead dropped into the good product hopper. The process of color sorting depends

upon the principle of differentiating the color of foreign material from the good one by using advanced CCD or high resolution sensors which use image capturing process to check these unwanted / discolored or defected grains. The defects are removed at high speeds without any human interface. Sorters are often controlled by micro-processors and their sophisticated software allows the use of hundred different sorting programs storable on board

Aspiration System in Cleaning Plant: A good aspiration system is required to maintain cleanliness, safety, sanitation, and efficient operation of the Isabgol seed intake, pre-cleaning, and cleaning of the Isabgol seed in the cleaning house. Proper dust control is necessary to maintain industrial safety and an acceptable work environment. Maintaining all cleaning and conveying elements under a slight vacuum or negative pressure helps prevent leakage of dust into the atmosphere. Maintaining the proper air requirement in gravity- based cleaning equipment is essential for their basic function.

The aspiration system comprises a fan, a dust collector, and a network of ducts that is carefully designed and well- distributed to connect all equipment, conveying elements, and various other dust- generating sources. The branches of the duct work are designed to provide the necessary air volume at an appropriate pressure. Air requirements are different for different pieces of equipment and conveying elements. This design is achieved partly by appropriately sizing the ducts and selecting the fan and dust collector. System air- volume requirements are calculated by adding the air volumes required by the various pieces of equipment and the exhaust connections on conveying elements.



The total system air- pressure requirements are calculated by adding the pressure required at various connecting points to the calculated pressure losses resulting from resistance along the ducting system. This approach helps in selection of a fan of appropriate size. The main duct work is connected to the dust collector, which has filter bags to entrap all dust particles from the dust-laden air that passes through it. The suction side of the fan is connected to the dust collector, providing the required air under suction, or negative pressure, while the other end, which blows air out, is vented out of the building.

As their physical locations are far apart, it is more efficient to incorporate a common aspiration system for the intake, pre-cleaning, and storage of and separate systems for main cleaning, as common system contributes to pressure losses because of resistance over a long stretch of ducting. This approach is necessary because these systems may warrant different air requirements; some gravity- based cleaning equipment requires large volumes of air at elevated pressures to maintain processing performance

Elevators: The main body is Full covered cases, which are obtained from MS / SS frame, the head & base box is altered with the pulley.



The machine works with nylon or canvas tract for low-density matter and for huge material the string cable command be used instead of the belt. The bucket elevator is designed in vertical column standard shape, so the machine included low carpet space. it is a preferable alternative for lower floor space and discharge at the top utilization in enterprises

Weighing and dosing systems: Accurate weight are most important for recording the weight of purchased raw materials and sold finished products. Correct recording of these weights directly influences the success of the bottom line. Scales are used for control of the performance of the various processing steps, such as cleaning, conditioning, and DE husking, as well as to determine moisture loss in the finished- product area.

Packaging of products and by-Products: In *Wholesale Packaging*, automatic bagging equipment consists of a microprocessor controller, load cells, weighed and discharge chute with bag holder. The Microprocessor controls the whole machine to achieve and deliver the target weights i.e., 10, 25/30, 50 KG etc. and can be easily programmed by the user for required target



weights. Once the material reaches the target weight, it discharges into the bag. The filled bag is then de-clamped on slat conveyor which helps the bag to reach the Stitching Machine for bag closing.

A user friendly interface allows the operator to pre-select settings to obtain optimum operation and simple, easy adjustment of bag width and length to accommodate different bag sizes. This equipment ensures saving of labor hours and is easy to operate, hence, increases productivity.

In *Consumer packaging*, a **Vertical-Form-Fill-Seal (VFFS)** machines helps in packaging of flour in 1, 2 and 5 kg sizes. The equipment produces pillow and other pouches type like block bottom, etc with center seal. One kg capacity pouches can be filled at the rate of even 24-26 pouches per minute. Typically, machine construction is of M.S. and product contact parts are of S.S. The equipment comes with forming collar and pipe, pneumatic cylinders to perform sealing, knife to cut and seal cooling, splicing unit for easy roll change over, etc.



Both machines require a compressor and voltage stabilizer (in case of abnormal fluctuations in power supply). In both types of packaging, an augur filler type filling system is required. It is a filling mechanism which measures out a product, usually powder or free flowing solids, using an augur which is rotated for a predetermined number of revolutions in a conical hopper to discharge the required volume of product. The main benefit of these machines is their ability to control dust during the filling operation and are therefore used extensively for powders and dusty free

flowing solids. Fillers of this type are suitable for filling products at both low and medium speeds.

Chapter 4- SWOT Analysis of Technology

4.1 SWOT Analysis

The SWOT analysis of the modern technology in proposed in the above chapter is as under:

Strength	Weakness
<ul style="list-style-type: none"> • Modern technology facilitates higher efficiency and productivity. • Use of modern storage systems will ensure proper hygiene and largely reduced incidences of pilferages, leakages, improper handling of material, and various other factors that lead to losses in storage. • Use of modern cleaning methods eliminates impurities that pose as significant risk to health and safety. • Reduce the yield losses. • Use of modern cleaning methods eliminates impurities which impact downstream machine efficiency. • Modern DE husking and sieving methods facilitate relatively higher separation of products, thus ensure higher recovery. • Will enable production of premium quality Isabgol Husk, and thus ensure better margins. • Use of modern Grinders with larger capacities and modern techniques ensure higher productivity and reduced breakdowns. • Modern machines have non-corrosive material such as stainless steel or food grade plastics, which further support the food safety approach. • Isabgol husk is having a significant export demand. It is meant for direct or Indirect 	<ul style="list-style-type: none"> • The adoption rate of latest technology innovation can be an issue due to high capital investment involved. • Modern technology with higher capacities also increases working capital requirements. • Mere adding of few recommended machines in an existing traditional mill may not yield optimum results due to capacity mismatch/disequilibrium in the complete process. • Lack of awareness regarding the latest innovations in the Isabgol Husk processing line is another reason for low rate of adoption among Small or medium scale manufactures or Entrepreneurs wishing to start a fresh manufacturing unit. • Lack of proper Forward integration discourages some entrepreneurs to invest in modern technologies with large capacities (As Unjha Processors holds the Monopoly though Rajasthan is The Largest Producer). • New technologies require manpower to upgrade their skills for handling operations. In some cases, such skilled labor may not be easily available locally or only higher remuneration could attract such manpower. • Initial high cost could be incurred in launching Isabgol Husk and other by product brands.

<p>consumption and the market for such Industries is growing rapidly.</p> <ul style="list-style-type: none"> • Modern packaging methods significantly reduce man hours spent on the activity, while considerably increasing the accuracy in weighing and stitches/sealing. • Scientific design and engineering of manufacturing Centre's has positive impact on optimum space utilization, reduced leakages, reduced power consumption (by power saving in processes), better product output and manpower safety. • Atomization in the process line can decrease the dependency on the labor contractors. It also ensures minimum human handling of products. • Automation can also help real-time identification of problems and immediate trouble shooting. 	
Opportunity	Threat
<ul style="list-style-type: none"> • Scope for technology upgradation. • Key schemes of Central Govt. (like Kisan Sampada, etc) and State Govt. could be utilized to set up most modern plants. • Export demand is on the higher side as compared to domestic consumption. Scope of Forward linkage with industries such as Procter & Gamble, Various Trading agencies etc., on B2B basis. • Branding offers huge potential for product promotion. • Increased interest in health and nutrition is creating demand for Isabgol husk & other derivatives. • FPOs can invest in mini versions of recommended technologies, which are developed by Institutes & other reputed private players. • Increase market demand with better quality product- with least contamination 	<ul style="list-style-type: none"> • Automation does leads to lesser jobs (especially for unskilled jobs). • Competition with large (including global/national) players could mean thin margins in marketing of products. • Rapid developments in contemporary markets and requirements of the industry may lead to fast Technology obsolescence. • Technology once obsolete would require re-investment upon upgradation to latest technology. • Technology breakdown for a longer period may have much higher cost implications than a labour intensive firm.

Chapter 5- Indicative Project Profile for Rajasthan

5.1 Indicative Project Profile:

This section of the report outlines three project profiles that could be referred by entrepreneurs to select their most suitable option. Seeing the quantum of investment & export potential of the product, we propose low end technology option. Broadly, one small scale investment option has been showcased primarily to suit the investment capabilities of the entrepreneurs. Section 5.1 of this chapter individually showcase the financial feasibility of these projects.

The assumptions for the line of Isabgol husk processing for Operating Capacity utilization is given below.

Table 7: Assumptions for Operating Capacity utilization

Business Case - Assumptions	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Operating Capacity	0	60%	80%	85%	90%	90%	90%	90%	90%	90%

5.1.1 Project Cost

The total cost of the project is estimated at Rs 339.94 Lakhs, out of which civil cost constitutes Rs 227.28 Lakhs, plant and machinery constitutes Rs 77.24 Lakhs, utilities & support of Rs 14.57 Lakhs, Interest during construction of Rs 9.49 Lakhs and Preliminary & pre-operating expenses of Rs 11.36 Lakhs. The detailed description of each component of project cost is depicted in the tables below.

Table 8: Project Cost Summary

Capex Components	Amount (Rs. Lakh)
Civil Cost	227.28
Plant & Machinery	77.24
Utility & Support	14.57
Preliminary & Pre-operative expenses	11.36
IDC	9.49
Total Capex	339.94

Note: We have not considered the land cost in this business model

5.1.2 Proposed Means of Finance

The promoter's equity in the project is Rs 169.97 Lakhs which is 50% per cent of the total project cost. The term loan considered for the project is estimated at Rs. 169.97 Lakhs which is 50 per cent of the total project cost.

Table 9: Means of Finance Summary

Means of Finance	Amount (Rs. Lakh)
Total Project Cost	339.94
Funding	
Equity (Promoters Cost)	169.97
Debt	169.97
Total Funding Required	339.94

Note: We have not considered grant in aid being offered by Any Board or any other government entity/ institutions. Which may have an impact on the overall profitability of the project in a positive way.

5.1.3 Civil work

The total cost of civil work has been estimated to be Rs 227.28 lakhs. Cost of civil work comprises of the built-up cost of Isabgol Processing line, Raw material storage & Finished goods storage. The total cost of technical civil works has been arrived at on the basis of the estimates provided by the Chartered Engineer (Civil) and can be substantiated with the requisite certificate.

Table 10: Civil Cost Summary

Civil Cost	Total Area Required (SQFEET)	Total Civil Cost (Lacs)
Isabgol Processing Line , Finished good storage structure and Raw Material Storage structure		
	10200	227.28
Total Civil Cost		

5.1.5. Plant and Machinery

The total cost of plant and machinery has been arrived on the basis of quotation received from various suppliers of equipment and machinery. The total cost of P&M is considered as Rs. 77.23 Lakhs (including IGST). The following table captures the components under Plant & Machinery.

Table 11: Plant & Machinery

#	Plant & Machinery	Total Cost (In Rs Lakhs)
1	PRE CLEANING ROUND SIEVES	1.3
2	VIBRO GRADER WITH VIBRO MOTOR & ASPIRATOR	11.32
3	VIBRO DESTONER MACHINE	2.57
4	POLISHER	1.21
5	BUCKET ELEVATOR(5" BUCKET & HEIGHT 16 FEET) WITH GEAR MOTOR	2.99
6	BUCKET ELEVATOR(5" BUCKET & HEIGHT 28 FEET) WITH GEAR MOTOR	2.02
7	24" SIZE SELLER	14.53
8	STRUCTURAL & 4 MM PLATFORM	6.33

#	Plant & Machinery	Total Cost (In Rs Lakhs)
9	COUNTER SHAFT & PULLEYS	4.81
10	ELEVATOR 3" BUCKET WITH TOP & BOTTOM LINE FABRICATION	4.81
11	SUCTION FAN WITH 18 GAUGE CYCLONE & PIPELINE	6.68
12	SIEVES FOR LALI	4.75
13	HUSK CLEANING SIEVES, JALI & BALL SYSTEM	1.04
14	BOX TYPE FAN	1.21
15	GRAVITY SEPERATOR MACHINE	1.81
16	ELEVATOR 4" BUCKET, HEIGHT 12" WITH TOP & BOTTOM LINE	0.69
17	HOPPER & GRAVITY AIR PIPE FITTINGS	0.24
18	CONVEYOR BELT MAKE & FITTING	5.50
19	STORAGE BIN MAKE & INSTALLATION	2.75
20	WEIGHING SCALE	0.53
21	GUNNY BAG SEWING MACHINE	0.06
	Total	77.24

5.1.6 Assumptions

Table 12: Assumptions

Revenue Assumptions	Units		Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Installed Capacity											
Hours in a Day	8										
Number of Shifts per day	number		1	1	1	1	1	1	1	1	1
Installed Capacity	tonnes/day		2	2	2	2	2	2	2	2	2
Capacity Utilisation (%)	percentage		50%	80%	85%	90%	90%	90%	90%	90%	90%
Quantity of Isabgol Seed	tonnes/day		1.0	1.6	1.7	1.8	1.8	1.8	1.8	1.8	1.8
Product Mix			Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Isabgol Husk (99.8%)	tonnes/day		25%	25%	25%	25%	25%	25%	25%	25%	25%
Gola (For Animal Feed)			60%	60%	60%	60%	60%	60%	60%	60%	60%
Lali			10%	10%	10%	10%	10%	10%	10%	10%	10%
Khakha & Others			3%	3%	3%	3%	3%	3%	3%	3%	3%
Processing Losses		2.00%									
No. of Days of operation	no.		300	300	300	300	300	300	300	300	300
Operational Cost Assumptions	Units	YOY inc.	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cost of Procurement Price of Isabgol Seed	Rs/kg	2%									
			80	82	83	85	87	88	90	92	94
Selling Price Assumptions	Units	YOY inc.	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Isabgol Husk	Rs/kg	4%	600	624	649	675	702	730	759	790	821
Gola (For Animal Feed)	Rs/kg		18	19	19	20	21	22	23	24	25
Lali	Rs/kg		35	36	38	39	41	43	44	46	48
Khakha & Others	Rs/kg		33	34	36	37	39	40	42	43	45

5.1.7. Profit & Loss Statement

Profit and loss statement of the unit is as follows

Table 13: Income Statement

Profit & Loss Account (Rs. Lakh)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Isabgol Husk		537.84	745.80	824.11	907.50	943.80	943.80	943.80	943.80	943.80
Gola (For Animal Feed)		38.72	53.70	59.34	65.34	67.95	70.67	73.50	76.44	79.50
Lali		12.55	17.40	19.23	21.17	22.02	22.90	23.82	24.77	25.76
Khakha & Others		3.55	4.92	5.44	5.99	6.23	6.48	6.74	7.01	7.29
Total Income (Rs. Lakhs)		592.66	821.83	908.12	1,000.00	1,040.00	1,043.85	1,047.85	1,052.01	1,056.34
Raw Material										
Isabgol Seed for Husk & By Products output		286.85	390.11	422.79	456.61	465.74	475.06	484.56	494.25	504.13
Power		9.02	12.33	13.43	14.58	14.94	15.31	15.70	16.09	16.49
Packing Cost		2.69	3.59	3.81	4.03	4.03	4.03	4.03	4.03	4.03
Water		0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.12
Total Direct Expenses		298.64	406.12	440.12	475.32	484.82	494.51	504.40	514.49	524.78
Gross Profit		294.02	415.71	468.00	524.68	555.18	549.34	543.45	537.52	531.56
Manpower		30.12	31.63	33.21	34.87	36.61	38.44	40.36	42.38	44.50
Repairs & Maintenance		2.87	2.96	3.05	3.14	3.23	3.33	3.43	3.53	3.64
Insurance		0.91	0.96	1.01	1.06	1.11	1.17	1.22	1.29	1.35
Admin Expenses		2.00	2.10	2.21	2.32	2.43	2.55	2.68	2.81	2.95
Transportation Expenses		5.74	7.77	8.67	9.64	10.12	10.63	11.16	11.72	12.30
Total In-Direct Expenses		41.64	45.42	48.14	51.02	53.51	56.12	58.86	61.73	64.75
EBITDA		252.38	370.29	419.86	473.66	501.68	493.22	484.59	475.79	466.81
Depreciation for Civil Works		22.73	20.46	18.41	16.57	14.91	13.42	12.08	10.87	9.78
Depreciation on P&M		11.59	9.85	8.37	7.11	6.05	5.14	4.37	3.71	3.16
Depreciation on Others Components		1.46	1.31	1.18	1.06	0.96	0.86	0.77	0.70	0.63
Others (Amortization - IDC, Pre-ops, Contingency)		4.17	4.17	4.17	4.17	4.17	-	-	-	-
Sub-Total		39.94	35.78	32.13	28.92	26.09	19.42	17.22	15.28	13.57
EBIT		212.44	334.51	387.73	444.75	475.59	473.80	467.37	460.51	453.24

Profit & Loss Account (Rs. Lakh)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Interest on Term Loan		20.08	17.24	14.11	10.68	6.91	2.77			
Interest on Working Capital - Normal		1.80	4.04	3.14	3.47	3.63	3.63	3.63	3.19	3.06
PBT		190.55	313.23	370.48	430.59	465.05	467.40	463.74	457.32	450.19
Tax		9.40	61.27	109.27	127.30	137.64	138.34	137.25	135.32	133.18
PAT		181.15	251.96	261.21	303.29	327.41	329.05	326.50	322.00	317.01

5.1.8 Balance Sheet

The below mentioned is the balance sheet statement for processing line of Isabgol husk

Table 14 Balance Sheet

TOTAL LIABILITIES (Amount in Rs Lakh)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<u>A) Promoters Funds</u>										
Capital Contribution	94	118	118	118	118	118	118	118	118	118
PAT	-	181	252	261	303	327	329	326	322	317
PAT after appropriations	-	181	433	694	998	1,325	1,654	1,981	2,303	2,620
Sub-Total	94	299	551	812	1,116	1,443	1,772	2,099	2,421	2,738
<u>B)Long Term Loans</u>										
Term Loan - Outstanding	144	193	161	127	88	46	-	-	-	-
Sub-Total	144	193	161	127	88	46	-	-	-	-
<u>C) Current Liabilities</u>										
Creditors - others	-	0	0	0	0	0	0	0	0	0
Creditors - Raw Material	-	5	7	7	8	8	8	8	8	8
Bank Finance - Working Capital	-	16	26	29	32	33	33	33	29	28
Total Current Liabilities	-	21	33	36	40	41	41	42	38	37
TOTAL LIABILITIES	239	514	745	975	1,243	1,530	1,813	2,140	2,458	2,774
TOTAL ASSETS										
<u>D)Land</u>	-	-	-	-	-	-	-	-	-	-
<u>Fixed Assets</u>										
Gross Block (Civil + P&M)	84	214	283	252	224	199	177	158	140	125
Purchases	129	105	-	-	-	-	-	-	-	-
Less: Depreciation	-	36	32	28	25	22	19	17	15	14
Sub-Total	214	283	252	224	199	177	158	140	125	112
<u>E)Current Assets</u>										

TOTAL LIABILITIES (Amount in Rs Lakh)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Net Debtors	-	14	19	21	23	24	24	24	24	24
Cash & Bank Balance	8	190	448	707	1,001	1,312	1,614	1,958	2,291	2,621
Stock	-	10	14	15	17	17	17	17	18	18
Sub-Total	8	214	481	743	1,040	1,353	1,656	2,000	2,333	2,663
F)IDC, Pre-ops written off	17	17	13	8	4	0	0	0	0	0
TOTAL ASSETS	239	514	745	975	1,243	1,530	1,813	2,140	2,458	2,774

5.1.9 Financial Indicators:

Project IRR	95.82%
Pay Back Period (Years)	4.33
DSCR (Average)	6.29
DSCR (Minimum)	4.93

Annexure 1: List of Plant & Machinery Suppliers in India

Table 15: List of P&M Suppliers in India

#	Name of the Supplier	Location	Contact Number
1	Avity Agrotech Private Limited	Vadodra-Gujarat	8071683132
2	Ambika Vijay Iron And Brass Factory	Sidhpur-Gujarat	8048975197
3	Gd Agro Industries	Ambala	8048085116
4	Drashti Industries	Rajkot-Gujarat	8048722669
5	Krishna Industries	Sidphur-Gujarat	8042904121
6	Dhiman Agro Tech Co.	Ambala	8047006713
7	Shah Agro Engineering Works	Nizamabad	8071677347
8	Pepperl-Fuchs (India) Private Limited	Ahmedabad	7922893810
9	Alpha Agro Tech Engineering	Kairana	9457572157

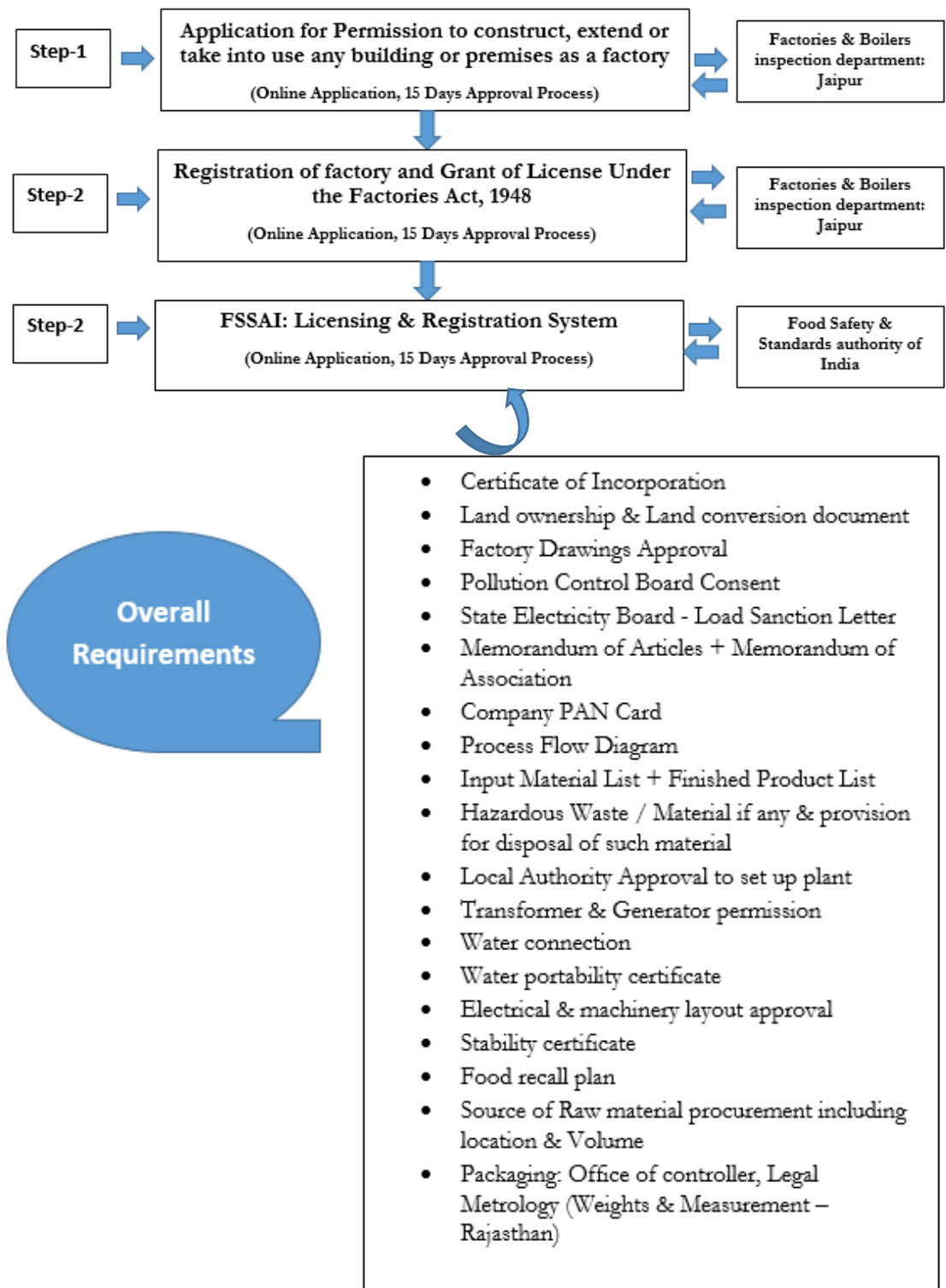
Annexure 2: List of Exporters from India for the Isabgol Seed/Husk (HSN:12119032): For B2B Linkage

Company name	Number of product or service categories traded	City	Website
Aatish Industries	9	Mumbai	
Abhyuday Industries	1	Sidhpur	http://www.abhyudaypsyllium.com
Adventa Export Private Limited	11	Ahmedabad	
Agistin Biotech Private Limited	14	Ahmedabad	http://www.agistinbiotech.com
Amar Overseas	3	Sidhpur	http://www.amaroverseasindia.com
Apollo Agro Industries Limited	1	Mehsana	http://www.apolloagro.com
Atlas Industries	2	Sidhpur	http://www.atlaspsyllium.com
Bhavin Exports	6	Ahmedabad	http://www.bhavinexport.com
Boom Buying Private Limited	1943	New Delhi	http://www.kompass.in/boom-buying-pvt-ltd
Dinesh Enterprises	10	Jodhpur	http://www.dineshgum.com
Everest Instrument Private Limited	6	Mehsana	http://www.everestinstruments.com
G. Gangadas Shah & Sons	70	Mumbai	http://www.ggs.com
Govind Madhav Industries	5	Mehsana	http://www.go-ind.com
Holista Tranzworld Limited	355	Chennai	http://www.kompass.in/holista-tranzworld
Jyot Overseas Private Limited	5	Ahmedabad	http://www.jyotoverseas.net
Jyotindra International	5	Palanpur	http://www.jyotindra.com
Kadam Exports Private Limited	3	Ahmedabad	http://www.kadampsyllium.com
Kanaiya Exoprts Private Limited	16	Ahmedabad	http://www.kanaiyagroup.com
Keyur Industries	3	Sidhpur	http://www.keyurpsyllium.com
Krome Group	20	Ahmedabad	http://www.kromegroup.net
Manek Minerals	68	Kutch	http://www.kompass.in/manek-minerals
Multiko International	63	Ahmedabad	http://www.kompass.in/multiko-international

Company name	Number of product or service categories traded	City	Website
Natural Agro Products	11	Ahmedabad	http://www.naturalagroproducts.com
North Gujarat Sat Isabgol Industries Private Limited	3	Unjha	http://www.ngsipl.com
Organic India Private Limited	3	Lucknow	http://www.organicindia.com
Oswal Psyllium Exports	1	Neemuch	http://www.oswalpsyllium.com
Pcot Export	23	Ahmedabad	http://www.pcotexport.com
Psyllium Export	5	Ahmedabad	http://www.psylliumexport.com
Quasar Exim Private Limited	17	Ahmedabad	http://www.quasarexim.com
R. C. Enterprise	1	Unjha	http://www.rcenterpriseindia.com
Rainbow Exports	20	Ahmedabad	http://www.kompass.in/rainbow-exports
Rama Industries	93	Deesa	http://www.kompass.in/rama-industries
Sarvoday Sat Isabgol Factory	3	Patan	http://www.sarvodaypsyllium.com
Satnam Psyllium Industries	1	Unjha	http://www.satnampsyllium.com
SB EXIM Corporation	4	Mehsana	
Shiv Psyllium Industries	1	Sidhpur	
Shree Panchganga Agro Impex Private Limited	68	Pune	http://www.panchganga.com
Sidhpur Isabgol Processing Company	1	Sidhpur	http://www.sat-isabgol.com
Step One Trading & Exim Private Limited	9	Sidhpur	
Sun Psyllium Industry	3	Unjha	http://www.sunpsyllium.com
Sunjay Pharma	9	New Delhi	http://www.sunjaypharma.com
Sunrise Industrial Corporation	106	Jalandhar	
Synergy Impex	20	Ahmedabad	
Unique Organics Limited	46	Jaipur	http://www.kompass.in/unique-organics-ltd
Universal Agro Commodities	50	Rajkot	http://www.kompass.in/universalagrocommodities/
Urvesh Psyllium Industries Limited	1	Sidhpur	http://www.urvesh.com
Vikas Industries	1	Sidhpur	http://www.psylliumindia.com

Annexure 3: Approval, Registrations & Licenses

Figure 19: Steps for approval, Registrations Licenses

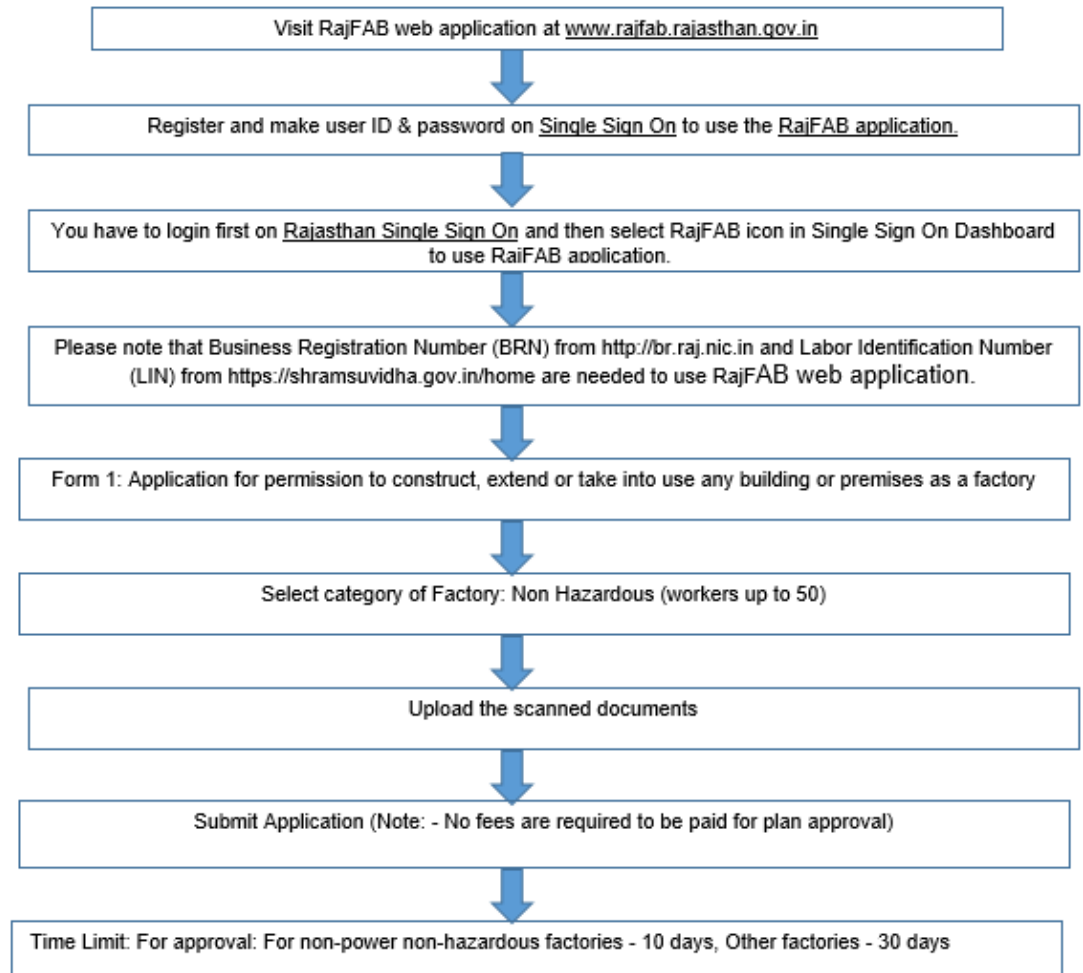


Step 1: Application for permission to construct, extend or take into use any building or premises as a factory

Application Process: Online

Submission to: Dy. Chief Inspector of Factories & Boilers- Jaipur

Filing Procedure:



Application Approval Procedure (Departmental):

- Application is submitted to the Dy. Chief Inspector of Factories and Boilers, if the factory employs up to 149 workers and of non-hazardous category else the application is submitted to the Chief Inspector of Factories and Boilers.
- Application is received online in Chief Inspector of Factories and Boilers, Jaipur/Dy. Chief Inspector of Factories and Boilers (Alwar, Bhilwara, Jaipur, Jodhpur, Kota or Udaipur) office for further actions in following steps: -

List of Documents:

1. Form No.1 signed by the occupier /Factory Manager (If form no.2 is submitted)
2. Form no 1-A (Affidavit on Non Judicial Stamp Paper of Rs.10/- signed by the occupier)
3. Land ownership Documents-Lease deed/rent deed/sale deed (In case of non RIICO land, also submit land use conversion order.)
4. Approved land Plan-RIICO site plan/khasara plan.
5. Brief description of the Manufacturing Process in its various Stage

6. Process Flow Chart.
7. List of All Raw Materials along with maximum storage capacity.
8. Plan/MAPS drawn to scale showing: -
 - a. The site of the factory and immediate surroundings including adjacent building and other structure, road, drain to a scale not less than 1 cm = 10 meters
 - b. The plan elevation and necessary cross-section of the factory buildings indicating all relevant details relating to natural lighting, ventilation and means of escape in case of fire, and the position of the plant and machinery, aisles and passage ways and shall be drawn to a scale not less than 1 cm = 2 meters
9. Attach Photo ID and Address proof of occupier
10. Attach Photo ID and Address proof of Factory Manager

“FORM No. 1
(See Rule3A)

**Application for permission to construct, extend or take into use any building or premises
as a factory**

1. Details of Occupier

- (a) Name: _____
- (b) Address (office): _____
- (c) Address (residential): _____
- (d) Contact number, if
any: _____

2. Details of factory

- (a) Full name: _____
- (b) Address with pin
code: _____
- (c) District: _____
- (d) Town or village: _____
- (e) Nearest railway
station
Nearest Police
(f) Station _____
- (g) Phone number, if any: _____

**3. Particulars of plant to be
installed & Manufacturing
process**

4. Maximum number of

5. Details of

- (a) Raw material
- (b) Intermediate product/by product
- (c) Final Product

6. Use of Chemicals in the manufacturing process, if any

S. No.	Trade name:	Chemical name:	Maximum storage at any time:

7. NOTE

- a) In case of any change in the above information, Department shall be informed in writing within 30 days.
- b) Seal bearing "authorized signatory" shall not be used on any document

Place:

Date:

**Signature of occupier with seal:
(Name)**

NOTE: This application shall be accompanied by the following documents: -

1. A flow chart of the manufacturing process supplemented by a brief description of the process in its various stage
2. Plans, in triplicate, drawn to scale as per rule 3A, showing:
 - (i) the site of the factory and immediate surroundings including adjacent buildings and other structures, roads, drains, etc.; and
 - (ii) the building & machinery layout plan, elevation and necessary cross-sections of the various buildings indicating all relevant details relating to natural lighting, ventilation, means of escape in case of fire (see rule 63) and any other provisions as mentioned in Chapter III "Health", Chapter IV "Safety" and Chapter V "Welfare" of the Factories Act, 1948 and rules made there under.The plans shall also clearly indicate the position of the plant and machinery, aisles and passage-ways.
3. Documents related to the ownership of the land:
 - (i) RIICO lease deed / Land use conversion document (in case land is not in RIICO industrial area); and
 - (ii) Rent deed / lease deed
4. Safety & Health Policy:

(i) in case of factory covered under clause (cb) of section 2 of the Factories Act, 1948; or

(ii) in case of factories covered under Rajasthan Control of Industrial Major Accident Hazards Rules, 1991 (RCIMAH), Submission of additional information / documents required under rule 7 of these rules.

5. Photo ID and address proof of the Occupier.
6. Such other particulars as the Chief Inspector may require.
7. Every page of the Documents submitted along with the Form should be self-attested by the Occupier along with date.

"FORM No. 1A

(See Rule3A)

Application for factories carrying out non-hazardous process and employing up to 50 workers

(To be filled by the occupier on a non-judicial stamp paper of Rs 10/-)

I.....S/o.....
.....R/o.....a
nd Occupier of M/s..... hereby
state as under:

1. That I have applied for registration of my factory in the name of M/s..... situated at (Complete address of the factory)
.....
.....
.
2. That I have gone through the Factories Act, 1948 & rules made thereunder and have fully understood the contents of the Act & Rules and undertake to abide by the same.
3. That I shall employ up to 50 workers.
4. That I shall inform and submit relevant necessary documents as per Act and Rules, in case of:
 - Change of building & machinery layout
 - Change in manufacturing process;
 - Addition of any manufacturing process, covered under clause (cb) of section 2 or section 87 of the Factories Act, 1948 or Rajasthan Control of Industrial Major Accident Hazards Rules, 1991; or
 - Employment of more than 50 workers.

Place:

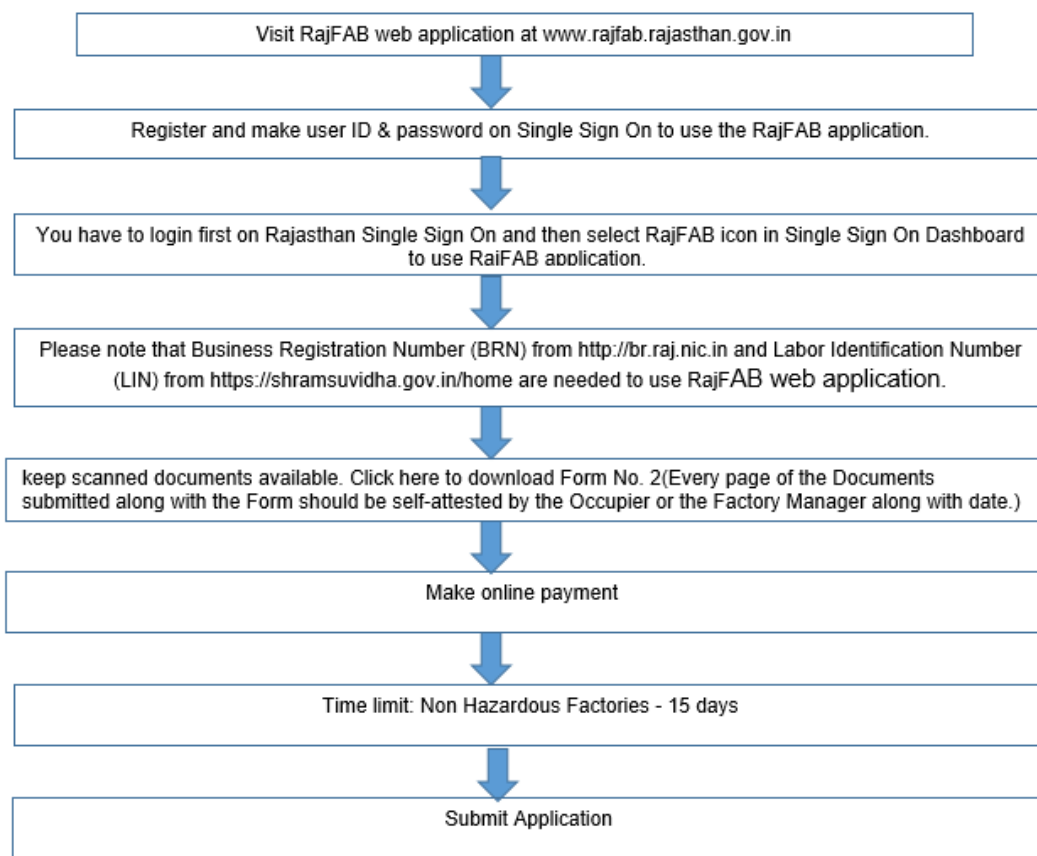
Date:

Signature of Occupier:

VERIFICATION

I the above named Occupier do hereby further solemnly affirm that the contents given above are true to the best of my knowledge.

Step 2: Registration of factory and Grant of License Under the Factories Act, 1948



Application Approval Procedure (Departmental):

1. Application is submitted to the Chief Inspector of Factories and Boilers, Rajasthan, Jaipur.
2. Application is received online in Chief Inspector of Factories and Boilers, Jaipur office for further actions in following steps: -
 - Application is received by the designated clerk who forwards the application to the examining officer.
 - Examining officer examines the application and attached documents.
 - If any entry in form is invalid/not correct/not supported by the attached documents or any attached document is not readable or correct then the examining officer submit the comments to the Dy. Chief Inspector of Factories and Boilers/Chief Inspector of Factories and Boilers as the case may be. The query will be send online to user to comply with.
 - After getting a complete application/compliance the Chief Inspector of Factories and Boilers issues and generate online license with his/her original scanned signature pasted on it.
 - User can download the signed approval.

Documents:

1. Form 2 duly signed by occupier.

2. Firm/Company ownership Document

- Latest List of partners / Latest List of Directors / Order of the Managing Agent appointed by Central Government/ State Government / Local Authority as occupier.
 - In case of change of Directors submit Form No. 32 of the Companies Act, 1956.
 - Partnership deed / Memorandum of Articles of Association.
3. Land ownership documents (Sale deed/Rent deed / Lease deed) with Land use conversion document if applicable.
4. Documents related to electrical power and date of start of production
- Load sanction copy & First electricity bill for registration.
 - Identification document
5. Photo ID and address proof of the Occupier.
6. Photo ID and address proof of the Factory Manager.

FORM No. 2

(See Rule 4, 5, 6, 7, 8)

“Application for registration / renewal /amendment/transfer of license and notice of occupation as specified in section 6 and 7”

(To be submitted in triplicate)

1. Period of license:

1.	YEAR (s) for which license is applied for	From	To
----	---	------	----

2. General Information:

2a	Full name of the factory	
2b	Factory registration number (if already registered)	

3. Address and contact information:

3a	Full postal address along with pin code and telephone number of the factory	
3b	Full postal address along with pin code for communications (if differ from above)	

4. Nature of manufacturing processes:

4a	Date of start of production (for registration)	
4b	Manufacturing process carried on in the factory during the last twelve months	
	Manufacturing process to be carried out in the factory in the next twelve months	

5. Workers employed:

		Male	Female	Total
5a	Maximum number of workers proposed to be employed during the year			
5b	Maximum number of workers employed during the last twelve months on any day			
5c	Number of workers ordinarily employed in the factory			

6. Power installed:

6a	Total rated horse power (installed or to be installed) (attach sanction load and first electricity bill)	
6b	Maximum amount of Power (H.P) proposed to be used	

7. Particulars of Factory Manager:

7a	Name and address of the person who shall be the Factory Manager (if appointed) of the factory for the purposes of the Act	Name	
		Residential address	
		Contact No. (if any)	

8. Particulars of Occupier:

8a	Name and address of the occupier (In case of private firm), Attach list of partners with complete details, (in case of partnership firm)	Name	
		Residential address	
		Contact No. (if any)	
8b	Name and address of the director in case of a Private/ Public limited company (Attach list of directors with details)	Name	
		Residential address	
		Contact No. (if any)	
8c	Full name and residential address of the Managing Agent in case where a managing agent is appointed by the Central Government / State Government / Local authority as Occupier	Name	
		Residential address	
		Contact No. (if any)	

9. Land & Building:

9a	Full name and address of the owner of the premises or building (including the precincts thereof) (referred to in section 93 of the Act)	Name	
		Residential address	
		Contact No. (if any)	
9b	Reference number and date of approval of the plans for site, whether for old or new building and for construction or extension of factory by the State Government / Chief Inspector		

10. Disposal of wastes and effluents:

10	Reference number and date of approval of the arrangements, if any made for the disposal of trade waste and effluents and the name of the authority granting such approval.	
----	--	--

11. Fees Details:

11	Total amount of fees paid	Rs.	
11a.	In case of payment in treasury	Name of Bank	
	<i>(Original Challan to be enclosed)</i>	& Branch	
		Challan	
		number	
		Date	
11b.	In case of payment in treasury	Name of Bank	
	<i>(Original Challan to be enclosed)</i>	& Branch	
		Challan	
		number	
		Date	
11c.	In case of online payment, details thereof		

12. Note

- a. In case of any change in the above information, Department shall be informed in writing.
- b. Seal bearing "authorized signatory" shall not be used on any document.

Place.....

Date.....

Signature of Factory Manager with seal & Name**Signature of occupier with seal & Name****Checklist: Documents to be submitted while filing application:**

1. This form should be completed in block letters or typed.
2. Every page of the form should be signed by the Occupier.
3. If power proposed is not used at the time of filling up this form, but is introduced later, the fact should be communicated to the Chief Inspector of Factories and Boilers immediately.
4. If any of the persons named against items 7(a) and 7(b) is minor, the fact should be clearly stated along with documents.
5. Any correction made in the Form should be duly signed by the Occupier or the Factory Manager.
6. List of documents to be enclosed:
 - a. Latest List of partners / Latest List of Directors.

- b. In case of change of Directors submit Form No. 32 of the Companies Act, 1956.
 - c. Partnership deed / Memorandum of Articles of Association.
 - d. Land ownership documents.
 - e. RIICO lease deed.
 - f. Land use conversion document (in case land is not in RIICO industrial area).
 - g. Rent deed / lease deed
 - h. Load sanction copy & First electricity bill for registration.
 - i. latest electricity bill for renewal
 - j. Photo ID and address proof of the Occupier and the Factory Manager.
7. Every page of the Documents submitted along with the Form should be self-attested by the Occupier or the Factory Manager along with date.

Annexure 4: Material Safety Data Sheet of Isabgol Husk

Table 16:Material safety datasheet for Isabgol Husk

Company Details
Phone
Fax
Identification	
Product Name	Psyllium Husk
Other Name	Ispaghula, Isabgol, Plantago Ovata
HS Code	121190
Physical Data	
Appearance	Light Beige Husk: Pale buff in color
Odour	Husk-Like
PH Value	Neutral
Solubility in water	Not soluble , but swells to form a gel
Hazards Identification	
Inhalation	Dust is Non-Toxic
Skin Contact	Nil
Eye contact	May irritate Eye
Ingestion	Ingestion of dust may irritate the gastro-intestinal tract
First Aid	
Inhalation	Move to fresh air, if discomfort occurs-Seek medical attention
Skin Contact	Flush with water, If irritation occurs-Seek medical attention
Ingestion	Drink Plenty of water
Fire	Non-Flammable
Accidental release measures	
Spills	Remove large spillages with a vacuum with a high efficiency filter. Flush remainder with plenty of water
Disposal	Dispose it as per local, State & National regulation
Handling & Storage	

Handling	Not classified as dangerous goods. The product is Non-Toxic. Wearing of PPE Recommended.
Storage	Store in cool & dry place in well closed clean godowns. Protect from Moisture, Rodents & Insects by fumigating the material every 30 days
Exposure Control	
Ventilation Measures	Good general ventilation
Respirators	Respirators approved for solid & liquid particles including dust & mist
Gloves	Rubber or Vinyl
Eye-Protection	Splash Goggles or safety glasses
Clothing	Lab coat or Apron & Hair mask
Stability & Reactivity	
Stability	5 Years
Reactivity	Non-Reactive
Toxicological Information	
Inhalation	Non-Toxic
Skin Contact	Single prolonged skin exposure causes no effect
Eye-contact	May cause mechanical eye irritation unless rinsed immediately with water
Ingestion	Non-Toxic. Drink plenty of water
Ecological Information	
Environmental Hazards	Non-Harmful
Toxicity	Non-Toxic
Transport Considerations	
Considerations	Not classified as Hazardous goods. Transportable by Road, Rail, Ship & Air. In a clean & sound container /Packages, protecting from Humidity, Rodents & Insects
Regulatory Information	
Hazard Label	Store in cool, dry place, in a well tight closed container/ packages. When kept open, keep moisture below 15%
Safety Phrases	Avoid breathing dust. Do not store near chemicals, oils, Heavy smelling materials

References

- **Trade Map: Trade statistics for international business development:** Monthly, quarterly and yearly trade data. Import & export values, volumes, growth rates, market shares, etc.
- **Market Analysis:** Futuremarketinsights.com
- **Global Industry analysis & forecast 2017:** Transparencymarketresearch.com
- **Value chain analysis Isabgol:** www.agriculture.rajasthan.gov.in
- **Factories & Boilers inspection department:** Jaipur, Rajasthan
- **NITI Ayog:** Rajasthan Agriculture Road map 2016

