

CRYOGENIC GRINDING OF SPICE

1. INTRODUCTION:

Spices are very important and essential for adding and enhancing flavor, taste and scent in preparation of food. They are also useful in preparation of certain medicine. India is the largest producer, consumer and exporter of spices Andhra Pradesh, Gujarat, Orissa, Rajasthan are major states producing varieties of spices. The project envisages setting up of a Spices Cryo-grinding unit. This is a new concept in spices processing, which results into higher production with better end product quality (aroma and color), than conventional spices grinding unit. This technology uses liquid nitrogen to control the grinding chamber temperature, the result of which is reduction in loss of volatile essential oils in the spices and higher production rate.

2. PRODUCT & ITS APPLICATION:

Spices are most important constituents of Indian food and cuisines, and are used not only for household purpose, but also in hotels, restaurants, eateries and food processing industries. They give aroma, taste and flavor to food. Curry powder, extensively used in Indian recipes, contains some time more than 20 different spices. Even in foreign countries, Indian spices are extensively used in preparation of food. Some of spices have medicinal properties and can be used in preparation of medicines and ayurvedic & cosmetic products.

3. DESIRED QUALIFICATIONS FOR PROMOTER:

Successful running this project does not require any specific qualification.

4. INDUSTRY LOOKOUT AND TRENDS

Application of these cryogenics in different aspects of food processing and preservation opens a new era of refrigeration other than conventional VCRS. Like every operation has some advantage and disadvantage, cryogenic application also has no exceptions. However, a judicious application can minimize the disadvantages and maximize the benefits available out of it. Amongst several applications, cry-grinding has tremendous potential. Specific Power consumption, size reduction, retention of colour and flavour of the ground samples definitely edge over conventional methods. Control and modified atmosphere storage is another important storage aspect now-a-days being tried out. Both controlling the atmosphere and the temperature are benefits of using cryogen. Ultra rapid freezing is the best of all freezing technique is well known. Cryogen can meet up this requirement easily. Now-a-days, researchers are also trying to use cryogen for production of dairy products such as ice cream. Cryogen can be effectively used for transportation of frozen foods. Several methods have been evolved and are real substitute of mechanical refrigeration techniques on board. Dry ice (Solid carbon-di-oxide) is commercially used for transporting heat sensitive food materials. Hence, if properly designed and planned, cryogenics can be friendly to the food industry.

5. MARKET POTENTIAL AND MARKETING ISSUES, IF ANY:

India is the largest producer and exporter of range of raw and processed spices. India leads in Cumin, Chili and Turmeric production in the world. Processed spices demand is directly linked with its consumption in food processing industry and this is set to grow in India in coming period with growth of population and fast changing food habits as well as increase in spending power of the middle and upper class in India. Even there is a good scope for exporting spices to other countries. The product holds export possibilities in countries like Japan, Sri Lanka, Iran, United Arab Emirates, United States of America, United Kingdom, and Ethiopia. There is a growing demand of pure/unadulterated grounded spices from the customers who are increasingly informed these days. With various food standards such as FSSAI, FSMS, ISI and ISO standards implementation, there can be huge market growth for manufacturer for packed spice and curry powder. Raw materials are easily available from the

local market anywhere in India. Marketing of spices is not complicated. Umpteen number of retail shops in and around the unit would be the prospective buyers of spices in bulk.

6. RAW MATERIAL REQUIREMENTS:

Various spices such as Red Chili, Haldi, Cumin seeds, Dhania, pepper, bay leaf, curry leaf, are required as essential raw materials. To pack dried powders, packing materials of food grade is required and to pack them in bunch, cardboard boxes are required.

7. MANUFACTURING PROCESS:

The material is feed into a feeder hopper and dropped into a conveyor when the material to be processed enters the pre-chilled conveyor; liquid nitrogen is sprayed and blended directly onto the material. The material is conveyed via a stainless steel special design auger. The auger not only transports the grinding media, but also mixes with liquid nitrogen for greater cooling efficiencies. The liquid nitrogen, a cryogenic fluid with a boiling temperature of -196°C absorbs heat from the material and vaporized to a gaseous state. The nitrogen gas exits the system conveying the process heat away from the process. Liquid nitrogen is added until the temperature of the material is reduced to a predetermined set point. This set point is the glass transition temperature of the material finally the brittle material enters an impact (pin) mill where it is ground to a desired particle size. Computer controls the entire process of cryogenic grinding system.

8. MANPOWER REQUIREMENT:

The enterprise requires 15 employees as detailed below:

Sr. No.	Designation of Employees	Salary Per Person	Monthly Salary ₹	Number of employees required				
				Year-1	Year-2	Year-3	Year-4	Year-5
	Variable Labour: Workers							
1	Operator	₹ 10,000.00	₹ 10,000.00	2	2	2	3	3
2	Un Skilled Workers	₹ 8,000.00	₹ 24,000.00	6	6	6	10	10
	<i>sub-total</i>		₹ 34,000.00	8	8	8	13	13
	Fixed Staff:							
1	Accountant	₹ 12,000.00	₹ 12,000.00	1	1	1	1	1
2	Store Keeper	₹ 8,000.00	₹ 8,000.00	2	2	2	3	3
3	Sales Staff	₹ 12,000.00	₹ 24,000.00	4	4	4	5	5
	<i>sub-total</i>		₹ 44,000.00	7	7	7	9	9
	Total		₹ 78,000.00	15	15	15	22	22

9. IMPLEMENTATION SCHEDULE:

The project can be implemented in 9 - 12 months' time as detailed below:

Sr. No.	Activity	Time Required (in months)
1	Acquisition of premises	2.00
2	Construction (if applicable)	3.00
3	Procurement & installation of Plant & Machinery	3.00
4	Arrangement of Finance	2.50
5	Recruitment of required manpower	1.50
	Total time required (some activities shall run concurrently)	9.00–12.00

10. COST OF PROJECT:

The project shall cost ₹ 169.13Lacs as detailed below:

Sr. No.	Particulars	₹ in Lacs
1	Land	25.00
2	Building	38.00
3	Plant & Machinery	32.75
4	Furniture, other Misc Equipments	1.10
5	Other Assets including Preliminary / Pre-operative expenses	3.28
6	Margin for Working Capital	69.00
	Total	169.13

11. MEANS OF FINANCE:

Bank term loans are assumed @ 75% of project cost. The proposed funding pattern is as following:

Sr. No.	Particulars	₹ in Lacs
1	Promoter's contribution	42.28
2	Bank Finance	126.84
	Total	169.13

12. WORKING CAPITAL CALCULATION:

The project requires working capital of ₹69.00Lacs as detailed below:

Sr. No.	Particulars	Gross Amt	Margin %	Margin Amt	Bank Finance
1	Inventories	34.50	0.25	8.63	25.88
2	Receivables	17.25	0.25	4.31	12.94
3	Overheads	17.25	100%	17.25	0.00
4	Creditors	-		0.00	0.00
	Total	69.00		30.19	38.81

13. LIST OF MACHINERY REQUIRED:

A detail of important machinery is given below:

Sr. No.	Particulars	UOM	Qty	Rate (₹ in Lacs)	Value(₹ in Lacs)
	Plant & Machinery / equipments				
a)	Main Machinery				
1	Blower	Nos	1	₹ 2.50	₹ 2.50
2	Rotary Valve	Nos	1	₹ 3.35	₹ 3.35
3	Eddy-current screw cooler with liquid N2 supply	Nos	1	₹ 4.25	₹ 4.25
4	Impact mills	Nos	1	₹ 3.70	₹ 3.70
5	Filter	Nos	1	₹ 3.20	₹ 3.20
6	Temperature sensors- Hosokawa	Nos	1	₹ 4.00	₹ 4.00
7	Screw feeder	Nos	1	₹ 3.80	₹ 3.80
8	Product container – Storage Tank	Nos	5	₹ 0.45	₹ 2.25
9	Tank for liquid nitrogen storage with circulation insulated piping for nitrogen and pumps etc;	Nos	1	₹ 1.30	₹ 1.30
10	Packing, Filling and Sealing Machine	Nos	1	₹ 2.00	₹ 2.00
11	Weighing Scale	Nos	3	₹ 0.25	₹ 0.75
12	Material Handling Equipment	LS		₹ 0.90	₹ 0.90
13	Misc Tools	LS		₹ 0.75	₹ 0.75
	<i>sub-total Plant & Machinery</i>				₹ 32.75
	Furniture / Electrical installations				
1	Office furniture and Electrification	LS	1	₹ 1.10	₹ 1.10
	<i>sub total</i>				₹ 1.10
	Other Assets				
1	preliminary and preoperative	LS		3.28	₹ 3.28
	<i>sub-total Other Assets</i>				₹ 3.28
	Total				₹ 37.13

All the machines and equipments are available from local manufacturers. The entrepreneur needs to ensure proper selection of product mix and proper type of machines and tooling to have modern and flexible designs. It may be worthwhile to look at reconditioned imported machines, dies and tooling. Some of the machinery and dies and tooling suppliers are listed here below:

1. Electrons cooling systems Pvt. Ltd.

S-27, SIDCO Industrial Estate
Kakkalur Industrial Estate
Tiruvallur – 602003,
Tamil Nadu, India

2. Springboard Enterprises India Ltd.

1st, 2nd & 3rd Floor,
Plot No. 7, 8 & 9,
Garg Shopping Mall,
Service Centre, Rohini Sector 2
New Delhi – 110085,
Delhi, India

3. Flour Tech Engineers Private Limited

Plot No. 182, Sector 24,
Faridabad - 121005,
Haryana, India

4. P Square Technologies

3, Swami Mahal,
Gurunanak Nagar,
Off. Shankarsheth Road Bhavani Peth,
Pune - 411002,
Maharashtra, India

5. Ricon Engineers

10 To 13, Bhagwati Estate,
Near Amraiwadi Torrent Power,
Behind Uttam Dairy,
Rakhial, Ahmedabad - 380023,
Gujarat, India

14. PROFITABILITY CALCULATIONS:

Sr. No.	Particulars	UOM	Year-1	Year-2	Year-3	Year-4	Year-5
1	Capacity Utilization	%	60%	70%	80%	90%	100%
2	Sales	₹. In Lacs	221.76	258.72	295.68	332.64	369.60
3	Raw Materials & Other direct inputs	₹. In Lacs	171.13	199.65	228.17	256.69	285.21
4	Gross Margin	₹. In Lacs	50.63	59.07	67.51	75.95	84.39
5	Overheads except interest	₹. In Lacs	15.66	16.64	18.60	19.19	19.58
6	Interest @ 10 %	₹. In Lacs	12.68	12.68	8.46	6.34	5.07
7	Depreciation @ 30 %	₹. In Lacs	9.83	7.37	5.90	3.93	2.95
8	Net Profit before tax	₹. In Lacs	12.46	22.38	34.56	46.49	56.79

The basis of profitability calculation:

This unit will have 3000 MT/Annum capacity. The growth of selling capacity will be increased 10% per year. (This is assumed by various analysis and study, it can be increased according to the selling strategy.)

Energy Costs are considered at Rs 7 per Kwh and fuel cost is considered at Rs. 65 per litre. The depreciation of plant is taken at 10-12 % and Interest costs are taken at 14 -15 % depending on type of industry.

15. BREAKEVEN ANALYSIS:

The project shall reach cash break-even at 29.21% of projected capacity as detailed below:

Sr. No.	Particulars	UOM	Value
1	Sales at full capacity	₹. In Lacs	369.60
2	Variable costs	₹. In Lacs	285.21
3	Fixed costs incl. interest	₹. In Lacs	24.65
4	$BEP = FC/(SR-VC) \times 100 =$	% of capacity	29.21%

16. STATUTORY / GOVERNMENT APPROVALS

The Ministry of Food Processing Industries has been operating several plan schemes for the development of processed food sector in the country during the 10th Plan. One of the schemes relates to the Technology Up-gradation/ Establishment/ Modernization of food processing industries.

The Indian food processing industry is regulated by several laws which govern the aspects of sanitation, licensing and other necessary permits that are required to start up and run a food business. The legislation that dealt with food safety in India was the Prevention of Food Adulteration Act, 1954 (hereinafter referred to as "**PFA**"). The PFA had been in place for over five decades and there was a need for change due to varied reasons which include the changing requirements of our food industry. The act brought into force in place of the PFA is the Food Safety and Standards Act, 2006 (hereinafter referred to as "**FSSA**") that overrides all other food related laws.

FSSA initiates harmonization of India's food regulations as per international standards. It establishes a new national regulatory body, the Food Safety and Standards Authority of India (hereinafter referred to as "**FSSAI**"), to develop science based standards for food and to regulate and monitor the manufacture, processing, storage, distribution, sale and import of

food so as to ensure the availability of safe and wholesome food for human consumption. Entrepreneur may contact State Pollution Control Board where ever it is applicable.

All food imports will therefore be subject to the provisions of the FSSA and rules and regulations which as notified by the Government on 5th of August 2011 will be applicable.

Key Regulations of FSSA

A. Packaging and Labeling

B. Signage and Customer Notices

C. Licensing Registration and Health and Sanitary Permits

17. BACKWARD AND FORWARD INTEGRATIONS

There is no change in fundamental principle of grinding under conventional and cryogenic conditions. Changes in quality of the material during grinding are very complex for the materials containing high amount of volatile oils and fats which are easily oxidized. Use of cryogen, such as liquid nitrogen (LN) serves dual purposes. It reduces the temperature of grinding and imparts an environmental condition not conducive for oxidative changes in the material being ground. All of thermo-sensitive herbal medicines spices and important food commodity can be ground below their brittle temperature, a temperature at which the material becomes brittle for which the material or the substance becomes easily fit for grinding.

Advantage of cryogenic grinding is that colour and other properties of the products will not be changed and their flavour and nutritional value will not be lost. Hence, the usefulness of cryogenic grinding can be summed up as:

- Conventional or ambient grinding of spices results in inferior quality of the products having several operational problems such as formation of dust.

- Application of cryogenic technology for grinding of spices has been scientifically proved to be a suitable technique with less loss of volatile oil content, improved colour and grinding operation.
- Information and data generated on properties of spices and cryogenic grinding would help to understand grinding phenomena and develop efficient grinding system

18. TRAINING CENTERS AND COURSES

There are few specialized Institutes provide degree certification in Food Technology, few most famous and authenticate Institutions are as follows:

1. Indian Institute of Food Science & Technology,
Plot No.1, Near Maa-Baap ki Dargah, Opp to Nath Seeds,
Paithan Road Aurangabad
Aurangabad - 431005
Maharashtra, India
2. MIT College of Food Technology, Pune
Gate.No.140, Raj Baugh Educational Complex,
Pune Solapur Highway,
Loni Kalbhor, Pune – 412201
Maharashtra, India
3. CSIR - Central Food Technological Research Institute (CFTRI)
Cheluvamba Mansion, Opp. Railway Museum,
Devaraja Mohalla, CFTRI Campus, Kajjihundi, Mysuru
Karnataka – 570020

Udyamimitraportal (link : www.udyamimitra.in) can also be accessed for handholding services viz. application filling / project report preparation, EDP, financial Training, Skill Development, mentoring etc.

Entrepreneurship program helps to run business successfully is also available from Institutes like Entrepreneurship Development Institute of India (EDII) and its affiliates all over India.

Disclaimer:

Only few machine manufacturers are mentioned in the profile, although many machine manufacturers are available in the market. The addresses given for machinery manufacturers have been taken from reliable sources, to the best of knowledge and contacts. However, no responsibility is admitted, in case any inadvertent error or incorrectness is noticed therein. Further the same have been given by way of information only and do not carry any recommendation.