

Reading Manual for Barley Flour

Under PMFME Scheme



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Contents

No	Chapter	Section	Page No
1	Introduction		3-9
1.1		Industrial Overview	3-5
1.2		Product Description	5-6
1.3		Market Potential	6-7
1.4		Raw Material	8
1.5		Types of Raw Material	8-9
2	Process & Machinery Requirement		10-20
2.1		Raw Material Composition	10
2.2		Source of Raw Material	10-11
2.3		Technologies	11-12
2.4		Manufacturing Process	12-15
2.5		Flow Chart with Machines	15-16
2.6		Additional Machine & Equipment	17
2.7		General Failures & Remedies	18
2.8		Nutritional Information of Product	19
2.9		Export Potential & Sales Aspect	19-20
3	Packaging		21-24
3.1		Shelf Life of Product	21-22
3.2		Barley Packaging	22-23
3.3		Types of Packaging	23-24
3.4		Material of Packaging	24
4	Food Safety & FSSAI Standards		25-31
4.1		Introduction to FSSAI	25
4.2		FSSAI Registration & Licensing Process	26-27
4.3		Food Safety & FSSAI Standards & Regulations	27-28
4.4		Labelling	29-31
5	Opportunities for Micro/Unorganized Enterprises	PM FME Scheme	32

Abbreviations & Acronyms

Sr.No.	Abbreviations &Acronyms	Full Forms
1.	FAO	Food and Agriculture Organization
2.	Kcal	kilocalorie
3.	APEDA	Agricultural and Processed Food Products Export Development Authority
4.	PET	Polyesters
5.	PA	Polyamide
6.	WVTR	Water Vapour transmission rate
7.	FSSAI	Food Safety and Standards Authority of India
8.	FBO	Food Business Operator
9.	FLRS	Food Licensing and Registration System
10.	PFA	Prevention of Food Adulteration
11.	MoFPI	Ministry of Food Processing Industries
12.	FPOs	Farmer Producer Organizations
13.	SHGs	Self Help Groups

CHAPTER- 1

INTRODUCTION

1.1.Industrial Overview:

Cereal Grains

Tiny, hard and edible dry seeds that grow on grass-like plants called cereals are cereal grains (or simply grains). In most nations, they are a staple food and have more food power worldwide than any other food category, by far. In human history, grains have played a major role, and grain agriculture is one of the key developments that fuelled civilization's growth. They are consumed by people, and they are also used for feeding and fattening animals. It is then possible to transform grains into many different food items.








Cereals are an essential component of the human diet and are an important source of starch and other dietary carbohydrates (dietary fibre) that play an important role in human consumption of energy and nutrients.




A whole grain consists of 3 main parts:

- Bran: The hard, outer layer of the grain. It contains fibre, minerals and antioxidants.
- Germ: The nutrient-rich core that contains carbs, fats, proteins, vitamins, minerals, antioxidants and various phytonutrients. The germ is the embryo of the plant, the part that gives rise to a new plant.
- Endosperm: The biggest part of the grain contains mostly carbs (in the form of starch) and protein.
- A refined grain has had the bran and germ removed, leaving just the endosperm.

1.1.1. Types of Cereal Grains

The cereals most commonly cultivated are wheat, rice, rye, Oats, millet, barley, corn (maize), and sorghum.

Image	Name	Description
	<p>Rice (<i>Oryza sativa</i>).</p>	<p>Rice is an excellent source of calories because of its starch content. It comprises 75-80% of starch, 7% of protein, 0.4-0.8% of lipids and 12% of water. The protein of rice oats is of highly digestible nature and contains 4.1mg/100g of protein lysine higher than wheat.</p>
	<p>Barley.</p>	<p>It is extremely nutritious and essential for malting. Usually used as an oat breakfast cereal, it is often used as animal feed. It is primarily grown on land that is unable to produce wheat.</p>
	<p>Sorghum</p>	<p>Highly nutritious and used as a feed for livestock.</p>
	<p>Millet</p>	<p>In China, Russia and Germany, millet porridge, mostly grown in Asia and Africa, is common. It may also be used as animal feed and bird feed for the manufacture of alcoholic beverages.</p>
	<p>Oats</p>	<p>They are a staple cereal in Scotland and are exceptionally nutritious and used in more than half of the world as breakfast cereals. It is normal to reduce weight and lower blood sugar levels because of the high content of fiber.</p>

	<p>Rye</p>	<p>Cold climate cereal grain, used to produce beer, breads, whiskeys, vodka, and sometimes used as animal fodder.</p>
	<p>Maize</p>	<p>Corn is a staple cereal used worldwide also as animal feed on continents such as South America and Africa. Cornflakes are a globally popular cereal, too.</p>
	<p>Wheat</p>	<p>Wheat is one of the oldest domesticated grains and a major cereal crop. In modern times, wheat is used to manufacture bakery items for meals, breakfast cereals, and oats. It can be grown on a wide variety of soils, but in temperate climates it thrives.</p>

1.2.Product Description:

In the manufacture of flat bread, for baby foods and for food specialties, barley flour is used. It is also a part of composite flours that are used to make bread raised from yeast. A decent binder and thickener offer pre-gelatinized barley flour, which has high absorbent properties. The mixture of pre-gelatinized barley flour with barley crunch creates barley breading.



Barley flour, blocked barley or un-pearled

hull less barley is milled from pearl barley. For pearl barley, 13 percent moisture content for 48 hours, 14 percent moisture content for 48 hours for un-pearled hull less barley, are optimums tempering conditions. Solar mills with blunted and smooth rolls and sifters are used for the milling method. If blocked barley or whole barley is used for the milling of barley flour, due allowance must be charged for the considerably higher quantity of goods

that the system would otherwise expect. Barley flour is also a by-product of the processes of cutting, pearling and polishing.

Malted barley flour is derived from the malt of barley. For bread flours that are poor in natural diastatic activity, malt flour is used as a high diastatic supplement, as a flavor supplement in malt loaves and for various other food items. Barley is one of the oldest domesticated crops in the world and is vying with wheat for the distinction of becoming the first type of wild plant under cultivation. After wheat, rice and maize, barley (*Hordeum vulgare*) is the fourth most important cereal in the world. One excellent source of B-complex vitamins and minerals is barley. Like other cereals, because of the low content of essential amino acids like lysine and threonine, barley is often considered nutritionally poor. Nevertheless, breeders have discovered genotypes of high lysine barley, which suggest the degree of nutritional enhancement in this crop. Genotypes of Barley have been categorized as hull less and hulled ones. Barley and oats, which contain a relatively high concentration of mixed glucans (1-3), (1-4), b-D glucans, are unique among cereals (b-glucans). Hulled barley contains 3-7 per cent b glucans while hull less may have as much as 16 per cent b-glucans.

Protein	18.50 %
Crude Fat	06.80%
Total Dietary Fiber	65.00%*
Ash	04.60%
Moisture	07.00% ⁱ

1.3. Market Potential:

Barley or Jau, referred to scientifically as *Hordeum vulgare* L. After rice, wheat and maize, it is one of the most significant cereal crops in the world. The barley plant is a Rabi cereal plant from the Poaceae family of grasses. In cooler and semi-arid parts of the world, barley crops are mostly found. Barley is believed to have originated in the Middle East. It was primarily cultivated for human consumption during the ancient period, but today the cultivation of barley is also used for animal feed, malt products and human food. The barley crop is cultivated on approximately 70 million hectares of land worldwide. Global production stands at around 160 million tons. Europe is the world's leading continent for barley growth, followed by Asia. The Russian Federation, China, Canada, the USA, Spain, France,

Australia, the UK and India are other barley growing countries. In India, the major producers of barley crops are Uttar Pradesh, Rajasthan, Madhya Pradesh, Haryana, Punjab and Himachal Pradesh. The global area under cultivation of barley has been steadily growing. Production increased to 132 million tones in 1971-72 and to 162 million tones in 1980, from 83 million tones in 1961-62. The USSR, the USA and Canada are the world's leading barley producing nations.

In India, barley is grown mostly in the country's northern region. In 1951-52, the area under cultivation was 0.72 million hectares, which rose to 1.75 million hectares in 1980 and yielded 1.6 million tons. The yield is in the order of 7.5 to 9.0 quintals per hectare, compared with a 19.5 world average. Output is mainly limited to Uttar Pradesh, Punjab and Haryana in India, but it can be grown anywhere the wheat can be. The barley crops in Haryana cover 58,000 hectares of land and the total yield is 160,000 tons.

1.4. Raw Material Description:

After malting and removal of sugar and starch via hot water extraction, Barley Flour is produced from barley. By indirect steam, the harvested barley is dried, milled and sifted to obtain flour that passes 100 percent of a US 40 mesh screen and 90 percent is retained by a US 120 mesh screens. Carbohydrates make up about 80 percent of the barley grain by weight. Starch is the single most abundant factor, accounting for up to 65 percent, but cell wall origin polysaccharides are also quantitatively essential and can account for more than 10 percent of the grain weight. Barley malt is generated through a regulated schedule of steeping and germination. During malting, the gross chemical changes detected are the net product of reserve material degradation. Breads such as barley bread are prepared using barley flour.

Often it is added to wheat flour, making hybrid flour that is used to prepare different breads. A darker-colour baked end-product is produced by its addition to wheat flour, and the product's taste often varies. Barley flour is also used in some specialty foods as an ingredient. Barley breading is another barley flour-prepared food product that can be prepared using pre-gelatinized barley flour and an additional barley crunch product, similar to Grape-Nuts cereal.

1.5. Types of Raw Material:

Three major types of barley exist:

- i. *Hordeum vulgare*: A spike notched on opposite sides with three spikelets on each notch bears this six-rowed barley type. A floret that later matures into a kernel carries each notch. This variety of barley is the world's most grown variety.
- ii. *Hordeum distichum*: This two-rowed form of barley bears kernel-producing central florets. It is sterile in its lateral florets.
- iii. *Hordeum irregulare*: This variety is not commercially grown. It has fertile central florets, and sterile or fertile or both may be lateral florets.

Sr:No.	Variety Name	Suitable Areas	Yield and Maturity
1	Amber	Eastern Uttar Pradesh	Grain yield: 25-30 q/ha Maturity: 130-133 days
2	Azad (K.125)	Eastern Uttar Pradesh, Bihar and West Bengal	Fodder yield: 150 q/ha, grain yield: 20 q/ha Maturity: 115-120 days
3	BG – 25		Grain yield: 30 q/ ha Maturity: 120-130 days
4	BG 108	Late sowing regions	Grain yield: 20-25 q/ ha Maturity: 120-125
5	Dolma	Rainfed regions of medium to high elevation of Himachal Pradesh and Uttar Pradesh hilly zones	Grain yield: 35-40 q/ ha Maturity: 140-150 days
6	Himani	Medium to lower hill-valleys of Himachal Pradesh and Uttar Pradesh	Grain yield: 32-36 q/ha
7	Jyoti	Irrigated areas of Haryana, Punjab, Uttar Pradesh, Delhi, north-western Rajasthan, Bihar and West Bengal	Grain yield: 35-40 q/ha Maturity: 120-125 days
8	Karan 201, 231 & 264	Mahendargarh part of Gurgaon, Haryana, Eastern areas of Madhya Pradesh and Rajasthan	Karan 201 – 38 q/ha Karan 231 – 42.5 q/ha Karan 264 – 46 q/ha
9	Kailash	Medium to low elevation of Himachal Pradesh rainfed hilly areas	Grain yield: 40 q/ha Maturity: 145-150 days
10	Kedar	Late sowing regions	
11	LSB-2	Higher altitude of Himachal Pradesh and Uttar Pradesh hilly areas	Grain yield: 25-30 q/ha Maturity: 145-150 days

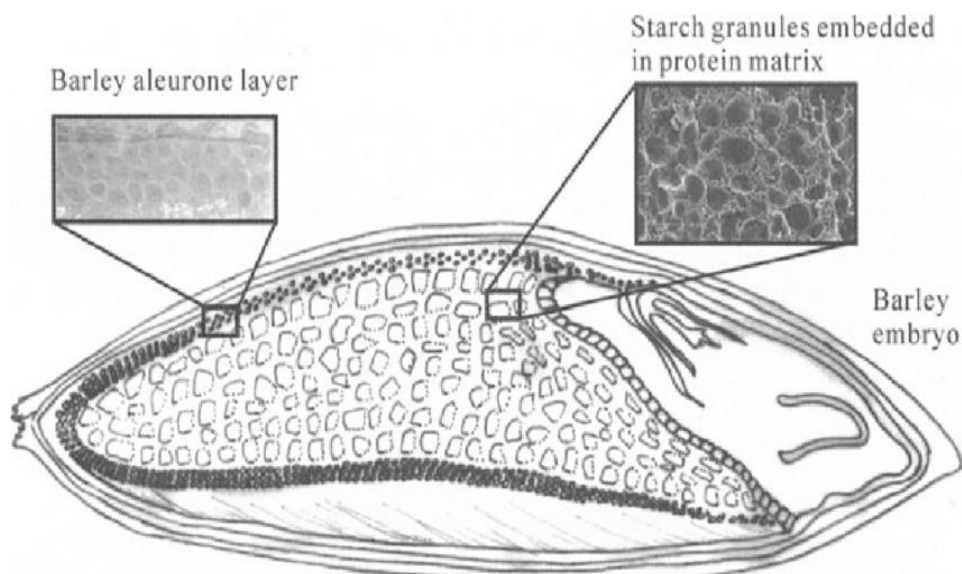
12	Neelam	Irrigated and rainfed areas of Punjab, Haryana, Bihar and Uttar Pradesh	Grain yield: 50 q/ ha
13	PL 56	Rainfed areas of Punjab	Grain Yield: 30 q/ ha
14	Ranjit (DL-70)	Irrigated areas of Punjab	Grain yield 30-35 q/ha
15	Ratna	Rainfed eastern Uttar Pradesh, Bihar and West Bengal	Fodder yield: 150 q/ha, grain yield: 20 q/ha Maturity: 125-130 days
16	RDB – 1	Irrigated areas of Rajasthan	Grain yield: 30-35 q/ ha
17	RS – 6	Rainfed and irrigated areas of central and eastern Rajasthan	Grain yield: 35 to 40 q/ha Maturity: 130-135 days
18	Vijaya	Rainfed areas of western Uttar Pradesh, Delhi and Madhya Pradesh	Grain yield: 30-35 q/ha Maturity: 120-125 days ⁱⁱ

CHAPTER 2

PROCESS AND MACHINERY REQUIREMENT

2.1. Raw Material Aspects:

Barley seeds are approximately eight millimetres in length and weigh approximately fifty milligrams when mature, although the variation between varieties is considerable. In most cases, the grain of barley harvested includes seed, a small structure called rachilla, and both palea and lemma, both of which are tightly attached to the seed. The barley grain to which these structures remain attached is referred to as the covered barley, the palea and the lemma generally referred to as the hull. However, barleys in which lemma and palea do not adhere to the seed. These hull-less barleys share harvesting features similar to seed is clearly separated from all other components of the spike.



The barley seed consists of an embryo, a series of outer layers of cells called the pericarp, and an endosperm. The endosperm contains various nutrients that the embryo draws from it as it develops into a plant. The main compound present in the endosperm is starch, which accounts for around two-thirds of the seed mass. This starch is a source of nutrition for seedlings. Another essential carbohydrate, -glucans, is a part of the endosperm cell walls. Protein is the second-largest portion of barley endosperm. The amount of protein present is generally inversely proportional to the amount of starch.

2.2. Source of Raw Material

Barley in India is grown in marginal, problematic, and resource-poor soils as a rainfed crop except for some malted barley under contract farming. India's annual production of barley is around 1.6-1.8 m tons and the area under cultivation stabilized around 0.65-0.70 m ha with a per hectare yield of around 2.4 qt. The major producing states of Barley in India are Rajasthan, Uttar Pradesh, Madhya Pradesh, Haryana, Punjab, and West Bengal. Rajasthan accounts for 40% of the overall barley production, led by Uttar Pradesh (31%), Madhya Pradesh (9%), and Haryana (6 percent).

2.3. Technologies:

➤ **Hand operated flour mill: Saddle stones**

Milling is the method of ground cereal grains into flour. Traditionally, this would have been done by grinding the grain between two stones, a lower, stationary stone called the quern stone, and an upper, mobile stone called the hand stone.



Saddle stones are the oldest known flour milling machines. A saddle stone is a piece of hard stone that is cradle-shaped and carries the grain. The sandstone will have been either a cylindrical piece of stone (worn in both hands and traced like a rolling pin over the grain) or a disc held in one hand with a vertical handle on its back (rather like an upside-down mushroom). These hand stones were used to crush the grain and fairly coarse flour was made. Before being used, the grain was also malted in order to make grinding faster. These work in a manner similar to modern millstones and consist of two circular stones, a static bed stone overlying a revolving runner stone. The grain joins the quern through a hole at the middle of the runner stone and migrates when it is ground to the edge, emerging as a coarsely ground flour from between the stones. These rotating querns are hand-powered and are thus constrained by their operator's strength in size and milling capability. They could, however,

be much heavier than the hand stone used for saddle querns, so they could be used to make finer flour with the unmalted grain.

➤ **Mills and mill stones:**

As the agricultural Production of cereals was the need for more efficient methods of flour production. In such mills, even larger circular-shaped stones would be used and a finer flour would be produced than that produced by handheld instruments. To move the spinning motion of the runner stone, power sources have been used. Initially, cattle or slaves used to turn these big stones around. Over time, the source of power to transform the millstone became water or wind.

Electric motors are used in modern flour mills that use spinning millstones. millstones do not touch when in operation. There is a distance between the rotating runner stone and the static bed stone that is defined by the grain scale. In the middle of the runner stone, the grain is fed from a chute into a cavity, referred to as the eye. The grain is spread over the millstone surface by a complex series of groves known as furrows, which help to ventilate and cool the millstones as well. The millstones' grinding surfaces are known as land and are separated into areas called harps. Once ground the flour passes along narrow groves called cracking and is expelled from the edge of the millstones.

➤ **Roller mills:**

As the population multiplied and the needfor more and better flour and bread increased, a modern method of milling was devised. By moving the grain through a series of paired counter-rotating rollers with fluted surfaces, these mills work. To separate the bran from the starchy endosperm, the resulting crushed grain is sieved between each pair of rollers. It is a super-fine white flour that is the finished result. To produce wholemeal flour from this type



of milling it is necessary to collect the bran that has been sieved off during the early stages of

milling and add them back to the final product. To obtain brown flour a proportion only of the extracted material is added back.




2.4. Manufacturing Process:





- **Grain delivery:** The grain is supplied by covered trucks and hopper railcars to factories. The distance travelled by the grain varies tremendously. In several times, the 110-car unit train has covered hundreds of miles. In other situations, it is shipped in the same county from a nearby plant. After arriving at the mill, grain stocks will often have gone through a variety of accumulation processes (farmer, country elevator, terminal elevator, etc.). The number of conveyances carrying grain can vary based on the time of harvesting and delivery.
- **Grain standard:** Before barley grains are unloaded in a factory, the assessment is required with samples. The grain is tested for moisture, test weight, unsound seeds, and foreign material. The grains are categorized according to Indian Grain Standards and are also subject to the ISO trade standards. Product management chemists start experiments to identify grain and assess end-user values during unloading.
- **Cleaning:** After inspection, the grain is unloaded directly from the truck into the unloading container and transferred into large bins or silos through conveyors and bucket lifts. Grain storing is a science. It is necessary to maintain the correct moisture, heat, and air or mildew, sprout, or ferment Barley. The grain can also be fumigated to eradicate insect pests during transportation. During the process In terms of nutrient level and consistency, barely is stored.
- **Cleaning the barley grains:** It can take as many as six steps. The machines that clean the grain are collectively called the cleaning house.
 - ✓ **Magnetic separator** – The grain first passes by a magnet that removes ferrous metal particles. It will pass through other metal detectors after milling to ensure that no metal pieces are in the finished product. Magnets are also positioned throughout the milling process and at the last step prior to load-out.
 - ✓ **Separator** – Vibrating or rotating drum separators remove bits of wood, straw, and almost anything else too big or too small to be the desired grain.
 - ✓ **Aspirator** – Air currents act as a vacuum to remove dust and lighter impurities.
 - ✓ **De-stoner** – Using gravity, the machine separates the heavy material from the light to remove stones that may be the same size as the desired grain.

- ✓ **Disc separator** – The grain passes through a separator that identifies the size of the kernels even more closely. It rejects anything longer, shorter, more round, more angular or in any way a different shape.
 - ✓ **Scourer**– The scourer eliminates the outer husks, the soil in the kernel crease, and other minor impurities with vigorous scouring action. Currents of air are dragging up all the loose stuff.
 - ✓ **Impact Entoleter**– The centrifugal force cuts down some unsound kernels or insect eggs and the aspiration rejects them from the flow of the mill. From the meet, the sound of the Barley flows into the grinding bins, large hoppers that regulate the feeding of the Barley to the actual milling process.
 - ✓ **Colour Separator** – Newer mills may also utilize electronic color separators to simplify the cleaning process.
- **Grinding:** The grains of barley are now ready to be milled into flour. The modern milling process is a gradual reduction of the barley grains through the grinding and sifting process. This science of analysis, blending, grinding, sifting, and blending results in consistent end product. Barley kernels are weighed or fed from bins to roller mills, corrugated cylinders made of chilled steel. The rolls are paired and rotated inward to each other at varying speeds. Passing through the corrugated "first break" rolls, the separation of the bran, endosperm, and germ begins.
- There are about five roller mills or breaks in the system. Again, the aim is to remove the endosperm from the bran and the germ. To get as much pure endosperm as possible, each break roll must be set. The "break" rolls, each has successively finer corrugations, through the break rolls. The grist is sent back upstairs to drop through sifters after each trip. The system reworks the coarse stocks from the sifters and reduces the Barley particles to granular "middling" that are as free from bran as possible.
- **Sifters-** Through pneumatic tubes, the broken particles of Barley are elevated and then dropped into huge, vibrating, box-like sifters where they are shaken to separate the larger from the smaller particles by either a series of bolting cloths or screens.
- There may be as many as 27 frames inside the sifter, each covered with either a screen or nylon or stainless steel, with square holes that get narrower and smaller and the farther down they go. It is probable that up to six different particle sizes come from a single sifter.
- **Blending:** From the fibre, the flour is separated and the process is repeated again.






- **Testing of the final product:** Lab checks are carried out after milling to ensure that the flour follows the specification and standards. Millers also conduct routine monitoring of indicator natural organisms. While dry flour does not provide an atmosphere that is conducive to microbial development, it is important to note that flour is not a ready-to-eat food and is a minimally processed agricultural ingredient. Flour is not meant for raw use. Baking, baking, boiling, and cooking heat processes are sufficient to kill any pathogens that may be found in flour and lower the possible risk of food borne disease.
- **Packaging of Product:** The packaging is carried out in a much simple process then milling, the Barley flour is fed to holding tank of the packaging machine, which simply seals one end of continuous packaging first, then it simply fills the packet as per required weight & seals the other end, generating the required packet.

2.5.Flow Chart:

Steps	Machine Name	Description	Machine Image.
Grain Delivery	Unloading Bins	These are large bins designed for unloading of grains & similar product; they are equipped with large rod mess to prevent big impurities from entering system.	
Grain Storage	Silos	These Equipments are class of storage Equipments which are specifically designed for dry grain raw material of small granule composition. Usually used to store grains but can also be used to store cement & aggregate.	
Cleaning	Vibrating Pre-Cleaner	It's composed of a vibrating sieve, powered by an exciter which is in turn is powered by an appropriate motor; which is used to remove most of the dirt & large impurities from given grain.	

Grinding	Heavy duty Pulveriser Mill	It basically a grinder class machine, which may employ any possible grinding arrangement to achieve, required grinding as per product to be grinded.	
Sifters	Flour Sifter Machine	It's basically an industrial version of the sieve used to sieve out, large fibers, particles etc, to achieve required particle size in flour.	
Finished Product Testing	Flour testing kit	This is the type of kit that measure moisture of flour before packaging of final product.	
Packaging & Storage	Packet Filling & Packaging Machine	It's a simple packaging machine, designed to fill the given food grade plastic material's continuous pouch with required product after sealing one end & after filling sealing the other end also to generate packet of product.	

2.6.Additional Machine & Equipment:

Machines	Description	Machine Image
De-stoner	It's a machine which is used to remove stones from the given grain, widely used in various grain mills in cleaning section.	
Disc Separator	It's a separator class machine, generally used to remove foreign grains from required grain efficiently	
Magnetic Separator	It's a type of separator which is used to magnetic impurities from given product using powerful electromagnets, used in wide range of industries for separation.	
Aspirator	It's a more fine-tuned separator designed to remove finer impurities like remaining dirt, similar sized impurities, leaves etc	
Food Grade Conveyor	These are conveyors with food grade belt to maintain food safety standards set by monitoring authorities.	

2.7.General Failures & Remedies:

S. No.	General Failures	Remedies
1.	Ball bearing failure of various machine	<ol style="list-style-type: none"> 1. Proper periodic lubrication of all bearings in various machines. 2. Regular replacement of all bearing to prevent critical failures.
2.	Power Drive Overload	<ol style="list-style-type: none"> 1. Ensure proper weighing & metering specially in case of semi-automatic plant. 2. Install warning sensor in buffer region of loading capacity to ensure efficient operation.
3.	Mechanical Key Failure	<ol style="list-style-type: none"> 1. Ensure that mechanical keys are replaced as per there pre-defined operational life. 2. Prevent Overloading.
4.	Loss of Interface	<ol style="list-style-type: none"> 1. This problem is dominant in newly established automatic plant, one must learn to maintain rules in plant & ensure no employee goes near transmission lines, unless authorised. 2. Provide proper physical shielding for the connections.
5.	Hulling	<p>Grain has the whole hull intact.</p> <p>Extra cleaning required for barley grains flour milling to sift out the impurities (dirt, chaff, etc.)</p>

2.8.Nutritional Information:**Barley (100 gram)**

Nutrient	Hulled barley	Pearl barley	Recommended adult intake
Energy (calories)	354	352	1,600–3,000
Protein (g)	12.5	9.9	46–56
Fat (g)	2.3	1.2	20–35
Carbohydrate (g)	73.5	77.7	45–65
Fiber (g)	17.3	15.6	22.4–33.6
Calcium (milligrams [mg])	33	29	1,000–1,200
Iron (mg)	3.6	2.5	8–18
Magnesium (mg)	133	79	320–420
Phosphorus (mg)	264	221	700
Potassium (mg)	452	280	4,700
Sodium (mg)	12	9	2,300
Manganese (mg)	1.9	1.32	1.8–2.3
Selenium (micrograms [mcg])	37.7	37.7	55
Folate (mcg)	19	23	400 ⁱⁱⁱ

2.9.Export Potential & Sales Aspect:

A non-wheat flour made by grinding the entire barley. It's a common alternative to wheat flour because it contains gluten, unlike many non-wheat flours.

It is a good substitute for a little whole grain twist for backed product and is a simple ingredient in the kitchen to play around with. Barley is one of the earliest cultivated grains, it has a mild, distinctive, and very slightly nutty flavor.

Barley contains a lower level of gluten than wheat, and as a result, Barley flour dough will not rise in the same way as wheat flour dough. It is pretty much evident from the research that the overall global barley flour market will be taking an emphasizing leap in the forecasted period and no demonstration of many falls in the global barley flour market is prominent in the near future. Barley has a lower gluten content than wheat, which ensures the barley flour dough will not increase in the same manner as wheat flour dough.

It is anticipated that growing awareness of the health benefits of barley flour combined with the simple availability of barley grains would fuel the sales growth of the global demand for barley flour. Another consideration is that the rapid rise in the use of barley flour is also expected to drive the development of the global barley flour industry in the dairy, bakery sectors, and healthy baby food preparation. The increased interest in traditional and traditional foods, where barley has for centuries been an important food grain, would also drive the global demand for barley flour.

CHAPTER3

PACKAGING

3.1. Shelf Life of Product:

Flour infestation is a common problem that both traders and flour millers face. Maintaining the consistency of the grain and its flour is a difficult task. With due treatment & managed conditioned climate, flour can be stored without any signs of damage for up to 6 months. Barley has very good shelf life that can extend up to few years. However, it is not known about the shelf of Barley flour after processing. The flour although lasts for 6 months without any alteration in the taste.

The moisture content of the Barley flour

- Storage Conditions
- Storage –Temperature & Humidity
- Cross Contamination
- Unhygienic Conditions
- Cracks on the floors & walls
- Standing water near the stores
- Spillage & bird faeces in the stores/stairs & floors
- Presence of grains germs in the flour.

In order to improve the shelf life of the flour, the following additional precautions should be taken by millers -:

- Use clean & fumigated grains for milling
- Use scouring machines in the cleaning line
- Set cleaning machines with optimum efficiency to separate out all the impurities from the Barley grains
- Clean the dead pockets of the cleaning line frequently, to get rid of non-moving grains at the elevator bottom & outlets, grains conveyor troughs, and tempered grain conveyors.
- Fumigate empty Grains bag.
- Before milling, use scourers to remove dirt in tempered grains
- Regularly clean the milling equipment like roller mills, feed hoppers, flour conveyors, gravity spouts, plan shifters purifiers, bran finishers, flour bins, flour elevators, flour packing hoppers, bran elevators line, etc.

- Fumigate packing materials before every use.
- Frequently fumigate bins & conveyors.
- Always keep the parking area & the flour storage area clean.
- Type of packaging materials used.

3.2.Barley flour Packaging:

Packaging refers to the act of designing and producing the container or wrapper of a product. It is one of the most important parts of marketing.

There are many factors that need to consider while selecting a suitable type of pack for the product:

- The product contents.
- The application of the product.
- Content stability.
- Protection from any environmental factors
- Acceptability of the pack to the customer.
- Regulatory, legal, and quality issues.

Characteristics of packaging material

- The material selected must have the following characteristics:
- Must meet tamper-resistance requirements
- Must not reactive with the product
- They must protect the preparation from environmental conditions
- Must be non-toxic
- Must not impart odour/taste to the product
- Must be FDA approved.

Flour is packed directly in gunny bags, gunny poly-line bags for bulk sale, and for retail sale in laminated pouches or poly-bags.

- **Hanging Bags-** Hanging bags in grocery stores and other shopping outlets are commonly used. They are a type of plastic bag that is also sealed with a back-middle seam on both ends as well. Hanging bags have a pre-cut hole that makes it easier for them to hang from hooks so that they can be seen in an attractive way.

- **Pillow bags** - A pillow bag is another typical type of package. The bags are named for their shape, which is like a cushion. They are found lying flat on grocery store shelves in the grocery store and were known to carry the items.
- **Gusseted Poly Bags-** Gusseted bags are often called flat-bottom bags because they feature a tucked in pleat that's been pressed flat. It allows the bag to expand for greater carrying capacity and to keep the shape of a box if necessary. These types of poly bags can be heat sealed, tied, stapled, or taped shut. They're the perfect poly bag for anyone looking to get more flour in a single bag.
- **Flexible Pouches-** Flexible pouches are a perfect way to carry most packaged items. They can be made with zipper-seal closures, which tend to keep the inside contents fresh for use. Flexible pouches offer amazing printing capabilities, so you can add your attractive product branding to the pouch itself. Many pouches stand up on their own, which helps you improve your shelf appearance.

3.3.Packaging:

- **Primary packaging:** Primary packaging is packaging which is in close association with the product itself and is often referred to as a consumer unit. The main purpose of the primary packaging is to contain, protect and/or conserve the final product, in particular against contamination.
- **Secondary packaging:** Secondary packaging is the outer packaging of the main packaging, which connects packages and further covers or marks the prescription component.
- **Tertiary packaging:** Tertiary packaging is used for the handling, transportation, and delivery of bulk products.



3.4. Material of Packaging:

In addition to cellulose and Aluminium foil, a very large amount of polymeric materials is used for packaging products. Paper boards and metal containers are also used for such purposes. While a range of packaging materials are available, the ultimate option of the packaging depends on the appropriate shelf life, the efficiency of the packaging machine, and the cost that is purely based on the market segment targeted by the manufacturer. The most common choice of packaging medium is plastic (usually flexible) as it offers the requisite safety and preservation, resistance to grease, physical strength, machinability, and printability.

Plastics that are lighter in weight are also the most preferred material for the packaging of flour. There are changing trends in the packaging of Flour. Plastic films and their laminates are increasingly used due to better properties and aluminium laminates due to price and better flex crack properties. Plastic packaging products that can be used are described below.

1. **Polypropylene-** Polypropylene films have better clarity than polyethylene and enjoy superior machinability due to stiffness. Lack of good salability has been a problem; however, PVDC and vinyl coating have been used to overcome this problem. Some varieties of PP have been specially developed for twist-wrap applications as they have the ability to lock in position after twisting.
2. **Poly Vinyl Chloride (PVC)-** PVC is a stiff and clear film having a low gas transmission rate. PVC can be used as small wraps, bags, and pouches. PVC when copolymerized with polyvinylidene chloride is known as Saran. Since it is a costly material, it is only used as a coating to obtain barrier properties and heat salability. PVC film is also used for twist wraps, as it has twist retention properties and is excellent on high-speed machines.
3. **Polyesters (PET) and Polyamide (PA)-** Polyethylene terephthalate film has high tensile strength, gloss, and stiffness as well as puncture resistance. It has moderate WVTR but is a good barrier to volatiles and gases. To provide heat seal property, PET is normally laminated to other substrates. Nylons or polyamides are similar to PET but have high WVTR.

CHAPTER4

FOODSAFETY REGULATIONS AND STANDARDS OF BARLEY FLOUR

4.1.Introduction to FSSAI:

The Food Safety and Standards Authority of India (FSSAI) has been established under Food Safety and Standards, 2006 which consolidates various acts & orders that have hitherto handled food-related issues in various Departments. The FSSAI is responsible for setting standards for food so that there is one body to deal with and no confusion in the minds of consumers, traders, manufacturers, and investors. The Act aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command.

Highlights of the Food Safety and Standard Act, 2006-

Various central Acts like Prevention of Food Adulteration Act, 1954 , Fruit Products Order , 1955, Meat Food Products Order , 1973, Vegetable Oil Products (Control) Order, 1947,Edible Oils Packaging (Regulation)Order 1988, Solvent Extracted Oil, De- Oiled Meal and Edible Flour (Control) Order, 1967, Milk and Milk Products Order, 1992 etc will be repealed after commencement of FSS Act, 2006.

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

Establishment of the Authority-

Ministry of Health & Family Welfare, Government of India is the Administrative Ministry for the implementation of FSSAI. The Chairperson and Chief Executive Officer of Food Safety and Standards Authority of India (FSSAI) have already been appointed by Government of India. The Chairperson is in the rank of Secretary to Government of India.

4.2.FSSAI Registration & Licensing Process:

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

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

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

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

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

or

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

Any person or entity that does not classify as a petty food business operator is required to obtain an FSSAI license for operating a food business in India.

FSSAI License - two types - State FSSAI License and central FSSAI License

Based on the size and nature of the business, the licensing authority would change.

- Large food manufacturer/processors/transporters and importers of food products require central FSSAI license
- Medium-sized food manufacturers, processor and transporters requires state FSSAI license.
- License period: 1 to 5 years as requested by the FBO.
- A higher fee for obtaining FSSAI license for more years.

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

4.3. Food Safety & FSSAI Standards & Regulations:

“2.4 Cereals and cereal products; 2.4.5 pearl barley (jau)” Pearl Barley (Jau) shall be the product obtained from sound and clean barley (*Horbeumvulgare* or *hordeumdistichon*). It shall be whitish in colour and shall be free from fermented, musty or other objectionable taste or odour, adulterants and insect and fungus infestation and rodent contamination. It shall not contain other foodgrains more than 1 per cent by weight. Barley powder shall be the product obtained by grinding clean and sound dehusked barley (*Hordeumvulgare* or *Hordeumdistichon*) grains. Barley starches shall not be less than 98.0 per cent by weight.

Sl. No.	Characteristics	Requirement
1.	Moisture,	Not more than 14.0 per cent (when determined by heating at 130-133oC for 2 hours).
2.	Total ash	Not more than 3.0 per cent (on dry weight basis).
3.	Ash insoluble in dilute HCl	Not more than 0.5 percent (on dry weight basis).
4.	Alcoholic acidity (with 90 per cent alcohol) expressed as H ₂ SO ₄ (on dry weight basis)	Not more than 0.5 percent (on dry weight basis). Not more than 0.17 per cent

Food Safety

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

SANITARY AND HYGIENIC REQUIREMENTS FOR FOOD MANUFACTURER/PROCESSOR/HANDLER

The place where food is manufactured, processed or handled shall comply with the following requirements:

1. The premises shall be located in a sanitary place and free from filthy surroundings and shall maintain overall hygienic environment. All new units shall set up away from environmentally polluted areas.

2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.
3. The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.
4. Floors, Ceilings and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.
5. The floor and skirted walls shall be washed as per requirement with an effective disinfectant the premises shall be kept free from all insects. No spraying shall be done during the conduct of business, but instead fly swats/ flaps should be used to kill spray flies getting into the premises. Windows, doors and other openings shall be fitted with net or screen, as appropriate to make the premise insect free The water used in the manufacturing shall be potable and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.
6. Continuous supply of potable water shall be ensured in the premises. In case of intermittent water supply, adequate storage arrangement for water used in food or washing shall be made.
7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.
8. No vessel, container or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the preparation, packing or storage of food. (Copper or brass vessels shall have proper lining).
9. All equipments shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.
10. All equipments shall be placed well away from the walls to allow proper inspection.
11. There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.
12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.

13. Persons suffering from infectious diseases shall not be permitted to work. Any cuts or wounds shall remain covered at all time and the person should not be allowed to come in direct contact with food.
14. All food handlers shall keep their finger nails trimmed, clean and wash their hands with soap, or detergent and water before commencing work and every time after using toilet. Scratching of body parts, hair shall be avoided during food handling processes.
15. All food handlers should avoid wearing, false nails or other items or loose jewellery that might fall into food and also avoid touching their face or hair.
16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.
17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.
18. The vehicles used to transport foods must be maintained in good repair and kept clean.
19. Foods while in transport in packaged form or in containers shall maintain the required temperature.
20. Insecticides / disinfectants shall be kept and stored separately and `away from food manufacturing / storing/ handling areas.

4.3.1. Labelling Standards(Regulation 2.5 of FSS)

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

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

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

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

Wherever applicable, the product label also must contains the following

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

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

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

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

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

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

According to the FSS Packaging and Labeling Regulation 2011, “prepackaged” or “pre packed food” including multi-piece packages, should carry mandatory information on the label.

Chapter5

OpportunitiesforMicro/UnorganizedEnterprises

5.1. PM-FME Scheme:

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

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

References:

ⁱ<https://www.ingredients101.com/barleyfl.htm>

ⁱⁱ<https://www.farmingindia.in/barley-crop-cultivation/>

ⁱⁱⁱ<https://fdc.nal.usda.gov/fdc-app.html#/food-details/170284/nutrients>

^{iv}<https://mofpi.nic.in/pmfme/docs/SchemeBrochureI.pdf>