Ministry of Food Processing Industries
Government of India

सत्यमेव जयते

NIFTEM
Knowledge. Innovation. Outreach

PROCESSING OF BARLEY FLOUR

AATMANIRBHAR BHARAT

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

INTRODUCTION

Industrial Overview:

- Cereals are an essential component of the human diet.
- They are important source of starch and other dietary carbohydrates (dietary fiber).
- Cereals play an important role in human consumption of energy and nutrients.
- In the manufacture of flatbread, baby foods, and for food specialties, barley flour is used.
- Barley flour, blocked barley or un-pearled hull less barley is milled from pearl barley.

INTRODUCTION

Industrial Overview:

- 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.
- 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 percent b glucans while hull-less may have as much as 16 percent b-glucans.

INTRODUCTION

Industrial Overview:

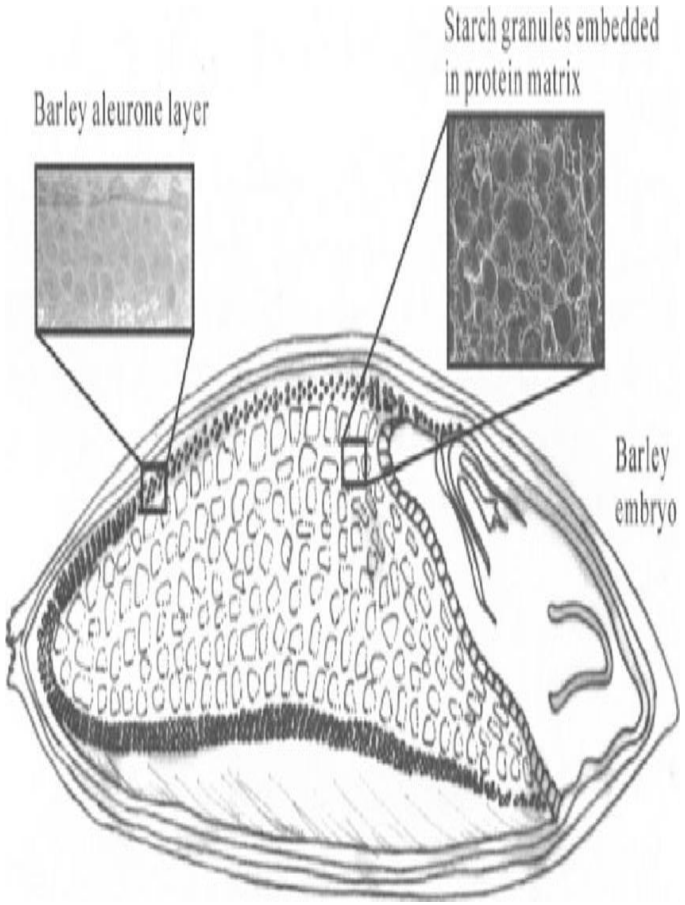
A whole grain consists of 3 main parts:

Bran: The hard, outer layer of the grain. It contains fiber, 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.



INTRODUCTION

Market Potential:

- The barley crop is cultivated on approximately 70 million hectares of land worldwide.
- Global production stands at around 160 million tons.
- 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.
- In India, the major producers of barley crops are Uttar Pradesh, Rajasthan, Madhya Pradesh, Haryana, Punjab, and Himachal Pradesh.
- Production increased to 132 million tones in 1971-72 and to 162 million tones in 1980, from 83 million tones in 1961-62.

INTRODUCTION

Raw material description

- Barley seeds are approximately eight millimeters in length and weigh approximately fifty milligrams when mature.
- The barley grain to which these structures remain attached is referred to as the covered barley.
- The pale 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.

INTRODUCTION

Types of Raw Material:

Three Major Types of Barley Exist:

- ***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.
- ***Hordeum distichum*:** This two-rowed form of barley bears kernel-producing central florets. It is sterile in its lateral florets.
- ***Hordeum irregulare*:** This variety is not commercially grown. It has fertile central florets, and sterile or fertile or both may be lateral florets.

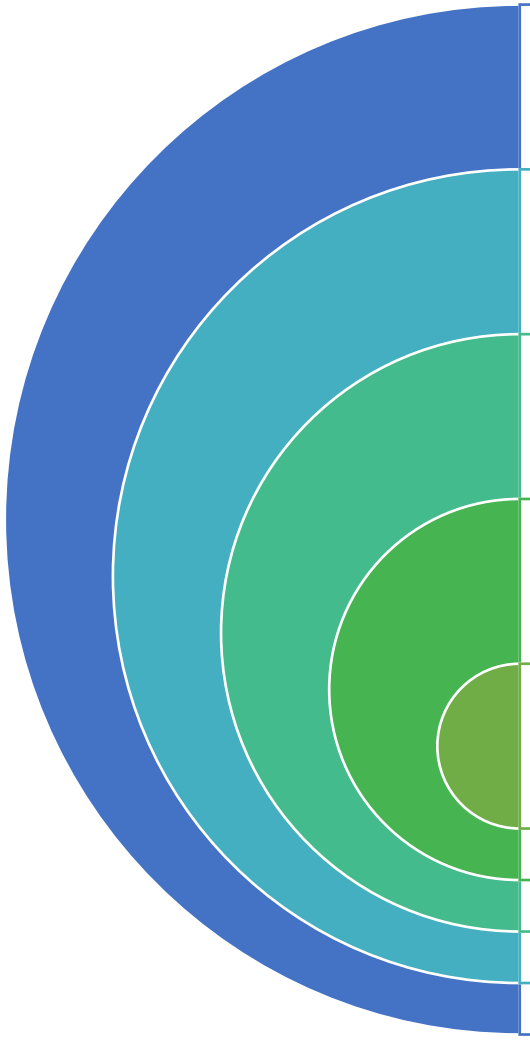
PROCESS & MACHINERY REQUIREMENT

Raw Material Aspects:

- 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.
- The amount of protein present is generally inversely proportional to the amount of starch.

PROCESS & MACHINERY REQUIREMENT

Source of Raw Material:



Barley in India is grown in marginal, problematic, and resource-poor soils as a rainfed crop.
India's annual production of barley is around 1.6-1.8 m tons.
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).

PROCESS & MACHINERY REQUIREMENT

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.
- These hand stones were used to crush the grain and fairly coarse flour was made.
- These rotating querns are hand-powered and are thus constrained by their operator's strength in size and milling capability.

PROCESS & MACHINERY REQUIREMENT

Technologies:

Roller mills

- By moving the grain through a series of paired counter-rotating rollers with fluted surfaces, these mills work.
- the process is necessary to separate the bran from the starchy endosperm.
- It is a super-fine white flour that is the finished result.
- To obtain brown flour a proportion only of the extracted material is added back.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Grain delivery:

- The grain is supplied by covered trucks and hopper railcars to factories.
- The distance traveled 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.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Grain standard:

- Before Pearl Millet is unloaded in a factory, the assessment is required with samples.
- The millets 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 Pearl Millet and assess end-user values during unloading

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Cleaning

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, Barley is stored.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Cleaning the barley grains: It can take as many as six steps. The machines that clean the grain are collectively called the cleaning.

Magnetic separator

- Separator
- Aspirator
- De-stoner
- Disc separator
- Scourer
- Impact Entoleter
- Colour Separator

PROCESS & MACHINERY REQUIREMENT

Manufacturing 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 inconsistent end product.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Sifting

- 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.

Blending

- From the fiber, the flour is separated and the process is repeated again.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

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.
- 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.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

Packaging of Product

- The packaging is carried out in a much simple process than milling.
- The Pearl millet flour is fed to the holding tank of the packaging machine.
- Then it simply fills the packet as per the required weight & seals the other end, generating the required packet.

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine	Description	Machine Image.
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.	
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.	

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine	Description	M
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.	
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.	

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine	Description	Machine Image.
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.	
Packet Filling & Packaging Machine	It's a simple packaging machine, designed to fill the given food-grade plastic material's continuous pouch with the required product.	

PROCESS & MACHINERY REQUIREMENT

Additional Machine & Equipment:

Machine Name	Description	Description 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.	

PROCESS & MACHINERY REQUIREMENT

Additional Machine & Equipment:

Machine Name	Description	Description Image
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.	

PROCESS & MACHINERY REQUIREMENT

General Failures & Remedies:

S. No.	General Failures	Remedies
1.	Emery Roller Wear in Dehusker	➢ They should be checked for their frictional properties & diameter periodically. ➢ Regular replacement of emery roller to ensure smooth & efficient operation.
2.	Ball bearing failure of various machine	➢ Proper periodic lubrication of all bearings in various machines. ➢ Regular replacement of all bearing to prevent critical failuraes.
3.	Power Drive Overload	➢ Ensure proper weighing & metering specially in case of semi-automatic plant. ➢ Install warning sensor in buffer region of loading capacity to ensure efficient operation.

PROCESS & MACHINERY REQUIREMENT

General Failures & Remedies:

S. No.	General Failures	Remedies
4.	Mechanical Key Failure	➢ Ensure that mechanical keys are replaced as per there pre-defined operational life. ➢ Prevent Overloading.
5.	Loss of Interface	➢ This problem is dominant in newly established automatic plant, one must learn to maintain rules in plant & ensure no employee goes near transmission lines, unless authorised. ➢ Provide proper physical shielding for the connections.

PROCESS & MACHINERY REQUIREMENT

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

PROCESS & MACHINERY REQUIREMENT

Nutritional Information: Barley (100 gram)

Nutrient	Hulled barley	Pearl barley	Recommended adult intake
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

PROCESS & MACHINERY REQUIREMENT

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 anticipated that growing awareness of the health benefits would fuel the sales growth of the global demand for barley flour.
- 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 would also drive the global demand for barley flour.

PM-FME SCHEME

The objectives of the scheme are:

- Support for capital investment for up-gradation and formalization with registration for GST, FSSAI hygiene standards and Udyog Aadhar;
- Capacity building through skill training, imparting technical knowledge on food safety, standards & hygiene and quality improvement;
- Hand holding support for preparation of DPR, availing bank loan and up-gradation;
- Support to Farmer Producer Organizations (FPOs), Self Help Groups (SHGs), producers cooperatives for capital investment, common infrastructure and support branding and marketing.
- https://mofpi.nic.in/pmfme/docs/SchemeBrochureI.pdf

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