Ministry of Food Processing Industries
Government of India

सत्यमेव जयते

NIFTEM
Knowledge. Innovation. Outreach

PROCESSING OF DAL MILL

AATMANIRBHAR BHARAT

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

INTRODUCTION

Industrial Overview:

- Dal or Pulses are defined as dried edible seeds of cultivated legumes
- Pulses occupy important place in human diet
- They serve as major sources of dietary protein & energy
- Pulses are consumed in its dehusked and split form
- This processed form of pulse is termed as dal
- Pulses are generally consumed in the form of Dal

INTRODUCTION

Industrial Overview:

- Pulse milling (Dal Milling) is accomplished in three major steps
- Namely: loosening of husk, dehusking and splitting of pulses
- Traditional methods for processing of pulses were resource intensive
- Modern technologies for pulse processing have replaced old methods
- Various methods are employed for pulse/Dal Mill (Tur Dal)ing
- Two broad classifications are wet & dry milling methods

INTRODUCTION

Market potential

- Global Pulse Market size was 115.3 Million Tons in 2019
- Expected to Grow at CAGR of 4.5% from 2020 to 2025
- It's projected to reach 143.7 Million Tons by 2025
- Indian Pulse Market Size was 24.7 Million Tons in 2018
- Market Drivers:
  - Increase in demand of High Protein Foods
  - Increasing Population
  - Increasing Pulse Production

INTRODUCTION

Raw Material Description

- The pigeon pea (*Cajanus cajan*), also known as Pigeonpea, Red gram, Tur.
- it is a perennial legume from the family Fabaceae or Leguminosae.
- its seeds have become a common food in Asia, Africa, and Latin America.
- It is consumed on a large scale in South Asia and is a major source of protein for the population of the Indian subcontinent.
- It is the primary accompaniment to rice or roti (flat bread) and has the status of staple food throughout the India.

INTRODUCTION

Types of Raw Material:

The following variety are consider as High-yielding varieties of Pigeonpea :

S. no.	Varieties	Av. yield (q/ha)	Special character
1.	TT 401	15-16	Indeterminate, early maturity and semi spreading, mid early maturing, resistant to wilt.
2.	PAU 881	12-13	Indeterminate, early maturing, semi spreading, suitable for pigeonpea-wheat cropping system
3.	Pusa 2002	16-17	Indeterminate, semi spreading, early maturing, suitable for pigeonpea-wheat cropping system
4.	GT 102	15-16	Indeterminate, spreading, shite and bold seeded, resistant to sterility mosaic disease and tolerant to pod borer and yields about 15-16 q/ha.
5.	PA 291	16-18	Tolerant to Phytophthora stem blight & Pod borer

INTRODUCTION

Types of Raw Material:

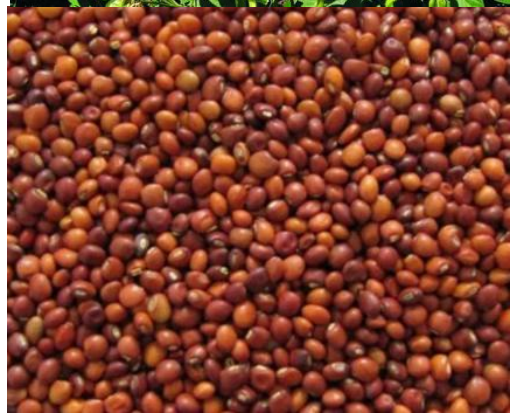
The following variety are consider as High-yielding varieties of Pigeonpea :

S. no.	Varieties	Av. yield (q/ha)	Special character
5.	Rajendra Arhar-1	28-30	Indeterminate, erect and compact, dark brown and oval seeds, resistant to sterility mosaic and moderately resistant to wilt
6.	CORG 8	18-20	Indeterminate, bold seeded (100 seed wt. 11g), resistant to sterility mosaic disease and tolerant to Helicoverpa armigera & Maruca vitarata
7.	BRG 4	12-16	Indeterminate, semi determinate, mid early, suitable for normal and delayed sowings
8.	BRG 2	12-16	Indeterminatye Semi spreading, green podding, bold seeded

PROCESS & MACHINERY REQUIREMENT

Raw Material Aspects:

- Pigeonpea is a perennial shrub grown for its edible pods and seeds.
- The origin of pigeon pea is either North-Eastern Africa or India.
- The fruit of pigeon pea is a flat, straight, pubescent pod, 5-9 cm long x 12-13 mm wide.
- It contains 2-9 seeds that are brown, red, or black in color, small, and sometimes hard-coated.



PROCESS & MACHINERY REQUIREMENT

Source of Raw Material:

- Pigeonpea, a Kharif season crop.
- It is the 2nd important pulse crop after the gram and a major Kharif crop in the country.
- India ranks 1st in area and production in the world with 80% and 67% of the world's acreage and production respectively.
- During 2016-17, the country recorded ever highest production of Tur to the tune of 45.99 lakh tons.
- More than 90% of production contribution of Tur is from 8 states, namely, Maharashtra, Karnataka, Madhya Pradesh, Uttar Pradesh, Gujarat, Jharkhand, Telangana and Andhra Pradesh.

PROCESS & MACHINERY REQUIREMENT

Technologies:

Wet Method

- The wet method of pulse processing involves a cleaning to remove dust, dirt, chaff, stone pieces, immature grains, and other seeds.
- After that, the easy-to-dehusk pulses are soaked in water for 2 to 8 hours.
- Pulses that are difficult to dehusk (Pigeonpea, black gram, green gram) are often handled with red earth.
- Following that, the pulses are dried before being dehusked and separated.

PROCESS & MACHINERY REQUIREMENT

Technologies:

Dry milling

- In case of dry method of pulse milling , the pulses after cleaning are fed into roller dehusker where a scratch, dent and crack is formed on the outer seed coat.
- Pitted pulses are then stored for 2 to 3 days after applying oil on the surface.
- Generally 150 -250 g oil per 100 kg pulses is applied.
- The oil diffuses between husk and cotyledon and thus facilitates the loosening of the husk.
- Water treatment helps in further loosening of the husk.
- Then the pulses are subjected to drying and cooling.
- Now, the dried pulses are dehusked and splited to obtain dal.

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

- Pigeon Pea crop is purchased from suppliers & unloaded in an unloading bin
- It has a rod or pipe grit to prevent large stones from entering the Pulse Mill
- Escalators carry the Pigeon Peas into the storage tank of milling plant
- From here the pigeon peas are feed to cyclone separator
- It simply cleans these pigeon peas by removing dust
- Pigeon peas are feed to Destoner
- While the dust is collected in a large dust collection bin

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

- Destoner simply removes stones from pigeon peas
- The stone fall of in a separate tank while pigeon peas fall into a silo
- From silo they are feed uniformly to various Emery Roll Dehusker
- They simply utilize their respective emery roller set to remove husk
- Whole tur dal along with removed husk is elevated to a higher level
- Where it's feed to another silo which, supplies it to Classifier Separator

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

- It simply remove any impurities like leaves, sand, other lighter grains
- Thus cleaned whole tur dal is obtained
- This whole tur dal is now feed to a Lentil Splitting Machine
- It simply splits the whole tur dal into two pieces
- Two halves falls in a silo; from where they are feed to Pulse grader
- It simply utilizes its vibration & grading trays to separate tur dal

PROCESS & MACHINERY REQUIREMENT

Manufacturing Process:

- Separating good dal from slightly broken & completely broken dal
- All these sorted components fall in separate silos
- While dirt is collected in a separate bin
- Each silo having their own feeder arrangement
- Feeder of these silos are opened after placing a sack in its open end
- So as to fill the sack with tur dal
- These sacks are then stitched utilizing a sack stitching machine
- They are weighed to verify weight content & are then sent for sale

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine	Description	Machine Image
Horizontal Cyclone Separator	➢ It's used to separate particulate matter within an air suspension using there weight difference. ➢ Used in wide range of plants ranging from thermal power plant to food grain processing plant.	
Destoner:	➢ It's a machine designed to remove stones from the given product, which in this case are pulses. ➢ Widely used in different food grain processing plants to remove stone like impurities.	

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine	Description	Machine Image
Emery Roll Dehusker:	➢ It's a machine which utilizes emery rollers to remove outer skin of pulses. ➢ The pulse or grain is simply pressed in-between emery rollers to break otter shell to liberate inner Endosperm.	
Classifier Separator	➢ It's a machine which is used to separate whole dehusked pulse from husk. ➢ Aspirator type machines utilize compressed air for cleaning purpose.	

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine	Description	Machine Image
Lentil Splitting Machine	➢ It's a machine designed to split the whole dehusked pulse into two halves, locally called as chakki. ➢ Different type of arrangements are available but to achieve this splitting.	
Pulse Grader	➢ It's a machine used to separate pulses into unbroken, partially broken & broken dal. ➢ This machine has it's own vibrator arrangement, which along with appropriate sieve or grader sheet can be effectively used for grading.	

PROCESS & MACHINERY REQUIREMENT

Flow Chart:

Machine	Description	Machine Image
Filling and stitching Machine	➢ The Automatic Weighing and Packing Machine support the process of precise weighing and packaging of animal feed pellets. ➢ The machine weighs the product with accurate measures and fills these in gunny bags.	

PROCESS & MACHINERY REQUIREMENT

Additional Machine & Equipment:

Machine Name	Description	Description Image
Weighing balance	Used for weighing the raw material and other product	
Material handling equipment	Material handling equipment is mechanical equipment used for the movement, storage etc. work.	

PROCESS & MACHINERY REQUIREMENT

General Failures & Remedies:

S. No.	General Failures	Remedies
1.	Ball bearing failure of various machine	➢ Proper periodic lubrication of all bearings in various machines. ➢ Regular replacement of all bearing to prevent critical failuraes.
2.	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
3.	Mechanical Key Failure	➢ Ensure that mechanical keys are replaced as per there pre-defined operational life. ➢ Prevent Overloading.
4.	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

Composition and nutritional data for Pigeonpea

Major minerals, Ca, K, P, Mg, Na, and trace minerals, Cu, Fe and Zn are found in pigeon pea.

The range of nutrients are:

❑ Protein - 22.3 %	❑ Calcium - 73 mg/100 g
❑ Fat - 1.7 %	❑ Phosphorus - 304 mg/100 g
❑ Minerals - 3.5 %	❑ Iron - 5.8 mg/100 g
❑ Fiber - 1.5 %	❑ Moisture - 13.4%
❑ Carbohydrate - 57.6 %	❑ Calorific value - 335 Kcal/100 g

PROCESS & MACHINERY REQUIREMENT

Export Potential & Sales Aspect:

- Grown as a food crop, pigeon pea is a tropical plant.
- containing high nutritional value which makes them suitable for diet supplements practically for protein deficient consumers.
- The persistent nature of the product to grow almost anywhere in the world allows the farmers to take multiple harvests.
- The pigeon pea market is expected to observe the highest growth owing to low price product demand coupled with high storage facility.
- India accounts for 33 percent of the world's area under pulses and 22 percent of production.

PROCESS & MACHINERY REQUIREMENT

Export Potential & Sales Aspect:

- Due to the mismatch between supply and demand for pulses (i e, shortage of supply) the prices of pulse crops increased sharply over the years
- To meet growing demand, India has been importing pulses in
- large quantities in recent years.
- long storages, advanced hybrid seed production technology, enhanced production capacity, and logistical infrastructure can full fill the demand of pulces in India
- To meet growing demand, India has been importing pulses in
- large quantities in recent years

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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