

# **Types of Milling method**

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## Milling of pulse

- Milling of pulse means removal of outer covering or husk and splitting the grain into two equal halves.
- The husk is tightly held by kernel so dehusking becomes difficult.
- Therefore the method of alternate wetting and drying is used to facilitate dehusking and splitting.
- There are about 4000 pulses mill (Dhal mills) in India. The average processing capacities of pulses mills in India vary 10-20 tonnes/day. In India, there are two conventional pulses milling methods ;

Wet milling method and

Dry milling method. – more popular and used in

commercial mills - Traditional dry milling method ('DHAL' MILLING)

DRY MILLING requires 3-4 days. It results in 75% of dhal recovery

General operations of dry milling method like

1. Cleaning and grading,
2. Rolling or pitting,
3. Oiling – Pretreatment with oil
4. Conditioning
5. Dehusking and splitting
6. Polishing

**Cleaning and grading** - Pulses are cleaned from dust, chaff, grits, etc., and graded according to size by a reel type or rotating sieve type cleaner.

**Pitting** - The clean pulses are passed through an emery roller machine. In this unit, husk is cracked and scratched. This is to facilitate the subsequent oil penetration process for the loosening of husk. The clearance between the emery roller and cage (housing) gradually narrows from inlet to outlet. As the material is passed through the narrowing clearance mainly cracking and scratching of husk takes place by friction between pulses and emery. Some of the pulses are dehusked and split during this operations which are then separated by sieving.

**Pretreatments with oil** - The scratched or pitted pulses are passed through a screw conveyor and mixed with some edible oil like linseed oil (1.5 to 2.5 kg/tonne of pulses). Then they are kept on the floor for about 12 hours for diffusion of the oil.

**Conditioning of pulses** - Conditioning of pulses is done by alternate wetting and drying. After sun drying for a certain period, 3-5 per cent moisture is added to the pulse and tempered for about eight flours and again dried in the sun. Addition of moisture to the pulses can be accomplished by allowing water to drop from an overhead tank on the pulses being passed through a screw conveyor. The whole process of alternate wetting and drying is continued for two to four days until all pulses are sufficiently conditioned. Pulses are finally dried to about 10 to 12 per cent moisture content.

**Dehusking and Splitting** - Emery rollers, known as Gota machine are used for the dehusking of conditioned pulses About 50 per cent pulses are dehusked in a single operation (in one pass). Dehusked pulses are split into two parts also, the husk is aspirated off and dehusked, split pulses are separated by sieving. The tail pulses and unsplit dehusked pulses are again conditioned and milled as above The whole process is repeated two to three times until the remaining- pulses are dehusked and split.

**Polishing** Polish is given to the dehusked and split pulses by treating them with a small quantity of oil and / or water. **Grading** of Dal using sieve.

## **Commercial milling of pulses by traditional methods**

The traditional milling of pulses is divided into two heads, namely, dry milling and wet milling. But both the processes involved two basic steps : (i) Preconditioning of pulses by alternate wetting and sun drying for loosening husk and (ii) subsequent milling by dehusking and splitting of the grains into two cotyledons followed by aspiration and size separation using suitable machines.

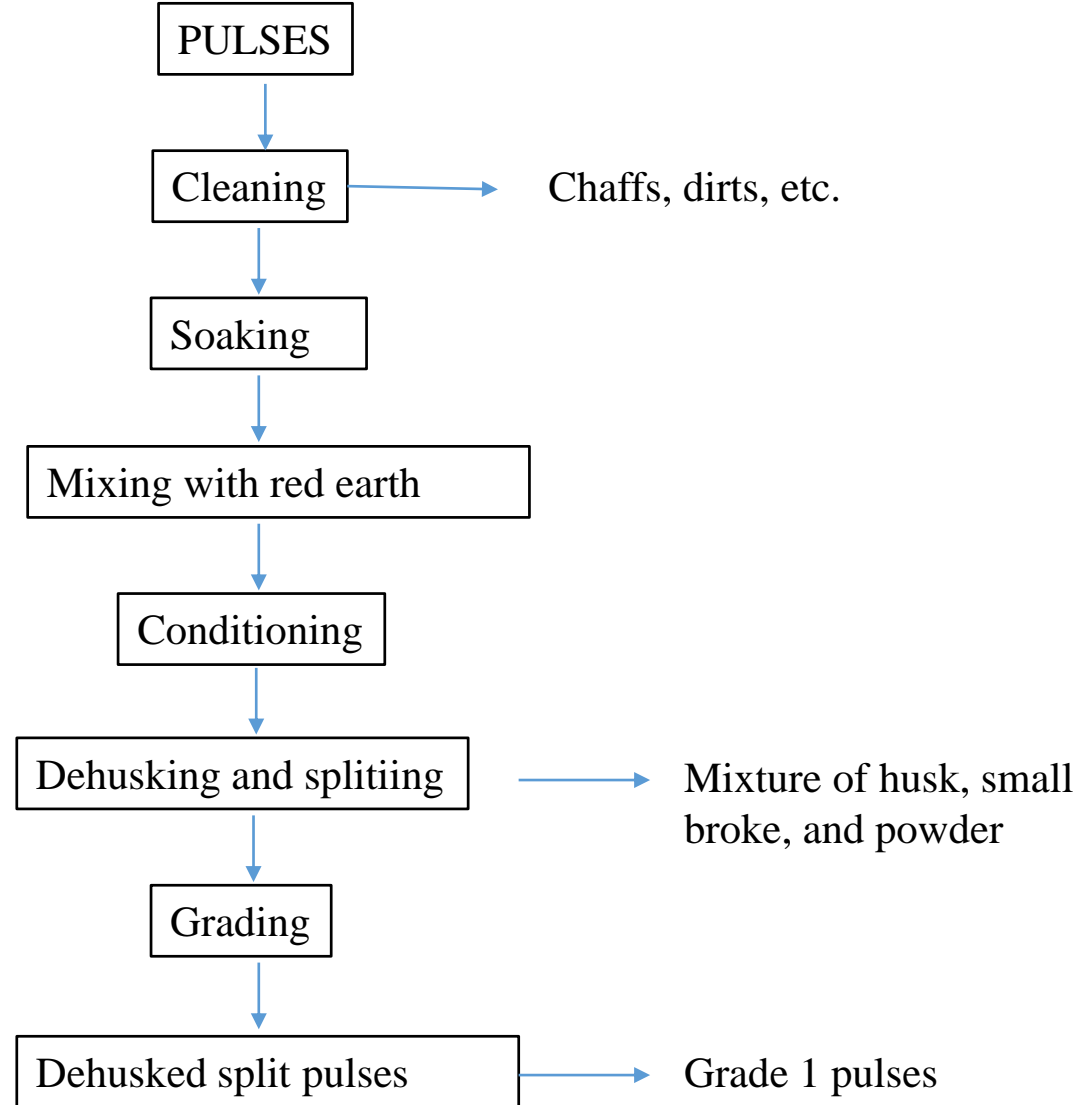
Milling losses are also quite high in the traditional method of milling of pulses. In general, simple **reciprocating or rotary sieve cleaners** are used for cleaning while **bucket elevators** are used for elevating pulses. Pitting or scratching of pulses is done in a **roller machine**. A **worm mixer** is used for oiling as well as watering of the pitted pulses. **Blowers** are used for aspiration of husk and powder from the products of the disc sheller or roller machine. **Split dhals** are separated from the unhusked and husked whole pulses with the help of sieve type separators. Sieves are also employed for grading of dhals.

# WET MILLING

Steps are as follow: ( It requires 4-5 days)

- 1.Cleaning
- 2.Soaking- It is done for 3-12 h
- 3.Mixing the soaked pulses with 3-5% red earth and heaped for 12 h
- 4.Sun Drying and tempering for 2-4 days
- 5.Separation of red eath: by sieving
- 6.Dehusking and splitting- 95-98 % are dehusked
- 7.Grading

It results in 72% of dhal recovery



# DAL MILLING MACHINE







# Milling efficiency

The overall efficiency of the pulse milling system can be estimated with the of the following equations.

$$1. \quad E = \left(1 - \frac{M_{uh}}{M_t}\right) \left(1 - \frac{M_b}{M_t}\right) \times H_t \times 100$$

where,  $H_t = \frac{H_a}{M_t H_t}$

$E$  = milling efficiency

$M_{uh}$  = mass of unhulled grains

$M_t$  = mass of grains fed to the system

$M_b$  = mass of broken

$H_a$  = actual mass of husk removed during milling

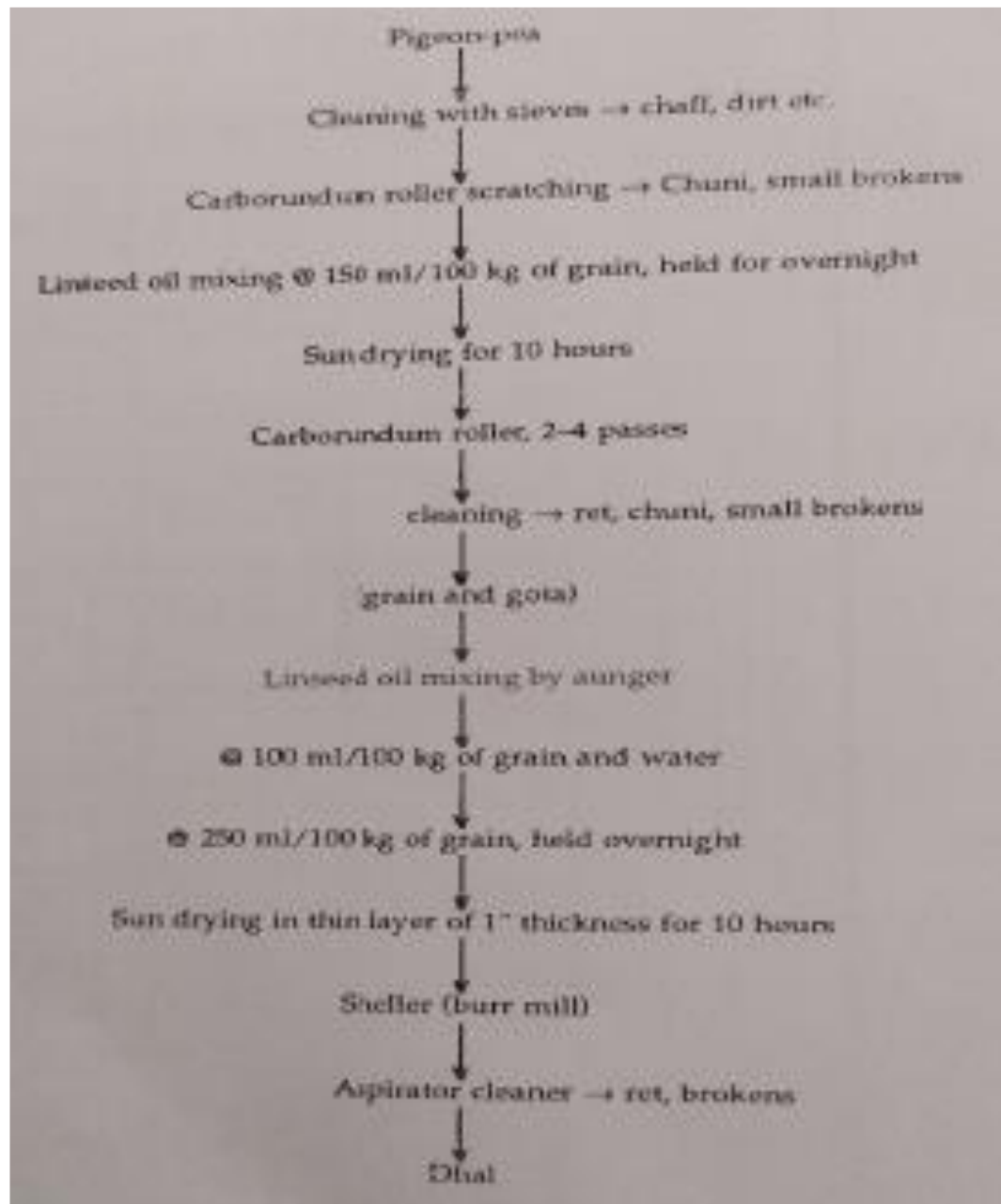
$H_t$  = theoretical husk content of the grain

The theoretical husk content of common Indian legumes are given in Table

Table 5.12  
Husk content of Indian legumes

Grain	Husk Content, %
pigeon pea	13.0-15.0
green gram	12.0
black gram	12.0
lentil	11.5
Bengal gram (chick pea)	11.5-13.0

## Milling of pulses in M.P. ( JABALPUR method)



# CFTRI method of pulse milling

- This method eliminates mixing of oil and water for loosening of husk.
  - Clean and graded grains are conditioned by dry heat treatment in 2 passes in LSU dryer with 120°C hot air.
  - Grains are tempered for 6 h after completing each pass.
- The flowchart of CFTRI method is given:

