ROHINI
COLLEGE OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF AGRICULTURAL ENGINEERING

AI3601 POST- HARVEST TECHNOLOGY

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Milling

Milling is the process wherein the rice grain is transformed into a form suitable for human consumption, therefore, to be done with utmost care to prevent breakage of the kernel and improve the recovery.

Brown rice is milled further to create more visually appealing white rice.

After harvesting and drying, the paddy is subjected to the primary milling operation which includes de-husking as w as the removal of bran layers (polishing) before it is consumed. In this process the rice which is obtained after milli called raw rice.

Another process through which rice is obtained after milling is called "Parboiling Rice." Nearly 60% of the total ric produced in India is subjected to parboiling.

Rice milling losses may be qualitative or quantitative in nature. Quantitative or physical losses are manifested by lo milling recovery while low head rice recovery or high percentage of broken kernel reflects the qualitative loss in ric grains.

Methods of Millling :

Traditional Method

Before the advent of mechanical milling, hand-pounding traditional method of rice milling was in practice.

In fact, hand-pounding rice has got more nutritive value as compared to machine milling rice.

In hand-pounding, a variety of implements is used such as:

Mortor and Pestle

Dhenki

Hand Stone (Chakki)

Mechanical Method

With the introduction of mechanized mills, hand-pounding method has steadily decreased because it could not compete with machine mills. The conventional mills in use can be categorized into three main types:

Huller mills

Sheller-Huller mills

Sheller-Cone Polisher mills.

Cleaning and Hulling

At the processing plant, the rice is cleaned and hulled. At this point, brown rice needs no further processing. If white rice is desired, the brown rice is milled to remove the outer bran layers. Hulling is the process to remove the hull from the kernel.

Manual hulling:

Hulling can be done by hand by rolling or grinding the rough rice between stones.

Advantages of parboiling of rice

- Dehusking of parboiled rice is easy and the grain becomes tougher resulting in reduced losses during milling
- Higher yield of head rice from milling because kernel is more resistant to breakage.
- Milled parboiled rice has greater resistance to insects and fungus infection.
- The nutritive value of rice increases after parboiling because the water dissolves the vitamins and minerals present in the hulls and bran coat and carries them into the endosperm.
- The water soluble B vitamins, thiamine, riboflavin and niacin are higher in milled parboiled rice than in milled raw rice.
- Parboiled rice does not turn into a glutinous mass when cooked.

Disadvantages of parboiling of rice

- It has a bad smell due to prolonged soaking.
- It has a dark colour due to heat treatment.
- It requires prolonged cooking time and more fuel.
- Since the oil content is more, the polisher may got choked.
- The heat treatment may destroy antioxidants. Hence, rancidity may develop.
- Due to the high moisture content, mycotoxins may be formed.
- Drying cost is added to the total processing cost, extra capital investment.

Mechanical hulling:

The rough rice is first cleaned by passing through a number of sieves that sift out the debris. Blown air removes top matter.

Once clean, the rice is hulled by a machine that mimics the action of the hand held stones.

The shelling machine loosens the hulls from the rice. About 80-90% of the kernel hulls are removed during this process.

From the shelling machine, the grains and hulls are conveyed to a stone reel that aspirates the waste hulls and moves the kernels to a machine that separates the hulled from the unhulled grains.

By shaking the kernels, the paddy machine forces the heavier unhulled grains to one side of the machine, while the lighter weight rice falls to the other end.

The unhulled grains are then siphoned to another batch of shelling machines to complete the hulling process

Polishing

Polishing is the process of removal of bran layer in brown rice.
After harvesting and drying, the paddy is subjected to the primary milling operation which includes de-husking as well as the removal of bran layers (polishing) before it is consumed.
The rice obtained after this process is called raw rice.

Quality and Grading

Quality of rice is not always easy to define as it depends on the consumer and the intende end use for the grain.
Grain quality is not just dependent on the variety of rice, but quality also depends on the c production environment, harvesting, processing and milling systems.

Characteristics Considered for Grading of Milled Rice

Dead rice, brokens and brewers percentages
Defectives
Foreign matter
Presence of paddy
Whiteness
Chalkiness
Moisture content

Objectives of establishing standards and grades

To ensure only edible rice reaches the consumer.
To improve post harvest practices so as to eliminate or reduce waste.
To improve agronomic practices to increase farm yields.
To improve processing practices for better milling recoveries and for market expansion.
To protect consumers from price/quality manipulation.

Grades of Indian Rice

Common variety: Short bold & long bold rice
Fine variety: Medium slender rice
Superfine variety: Long slender & short slender rice

Storage

Storage is the process of keeping grains, whether in bags or in bulk, in a storage structure designed to protect the stored product from inclement weather and pests for a short or long period of time to await processing or movement to other location.

Grains are stored for either of the following reasons:

To provide uniform supply of food throughout the year, because grains are produced seasonally while consumption fairly uniform throughout the year.

To provide reserve for contingencies such as flood, drought and other calamities.

To speculate on a good price either in domestic or in the export market.

The grains are stored at three different levels, such as:

Producer's Level

Trader's Level

Urban Organizational Storage Level

The methods followed for storing the grains are:

Storage in bags

Loose storage

Storage in bags is convenient for short term storage, where grain is intended for very early onward movement.

For short term storage, no control measures against insects are needed.

In loose/bulk storage method, large quantity of grains can be stored in per unit volume of space and the infestation o insects/pests is lower.

The basic requirements of a good storage practice are: a healthy, clean, and uniformly dried grain, and a structure th will maintain a suitable environment that will prevent pests.

Modern Rice Milling Process Steps & Paddy Rice Milling Systems Flowchart
Rice milling in modern age is the combination of several **commercial milling operations** that produce better quality white rice from rough rice (Rice Paddy)**.**
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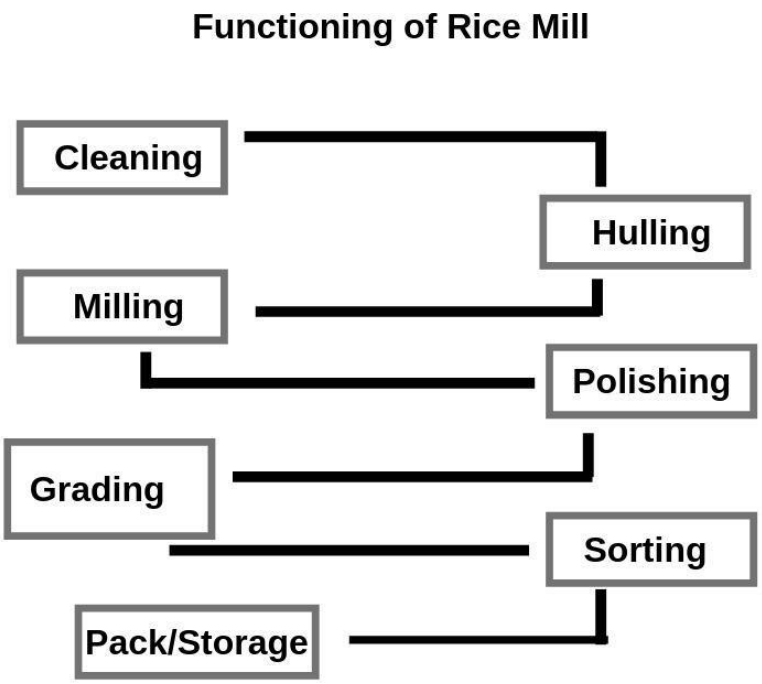
Modern Rice Milling Processes
Milled Rice is being produced, in Rice mills, after removing bran, husk and germ. Rice produced after modern rice milling process has different flavor, appearance (whiten) and extended life.
Would not you want to know more about this modern rice milling?
What is Rice Milling ?
Rice milling process is all about producing edible milled rice after separating the husk (20%), the bran layers (11%) & clean rice (69%) aka starchy endosperm.

modern rice milling process flow chart and steps

In an ideal milling process this will result in 20% husk, 8−12% bran depending on the milling degree and 68−72% milled rice or white rice depending on the variety.

Modern Rice Milling flow chart



Modern Rice Mill Process Flow Chart

Let's discuss rice mill functioning and **steps in rice milling** processes from pre-cleaning to packaging for sale.

Rice Pre-cleaning Process


raw paddy cleaning in modern rice mills

Paddy Rice cleaning process also called rice paddy cleaning process. It is first step in rice milling systems after rice paddy comes for milling process in rice mill from Rice farms.

Paddy always comes up having a lot of external material including weed, soil, seeds, etc. And these external things need to be removed before taking it to the hulling processes, so that the efficiency of the huller, as well as milling, would not get affected.

If they are not removed properly then the efficiency of the rice mill machinery can be reduced. The capacity of the paddy pre-cleaner is actually, 1.5 times the milling capacity. It makes rice milling an ideal in this modern age.

Rice Cleaning Process

Removing the husk (dehusking or dehulling)

Brown rice is actually produced by removing the husk from **rough paddy rice**. The husk is actually removed using friction so that paddy grains can easily pass in between two abrasive surfaces that move following different speeds.

It makes easy to let husk removed following suction and transported to a storage dump outside the mill. It means you would not have to confront a lot of hassle anymore.

Paddy separation

Paddy separator is good at unhusked paddy rice from brown rice making easier to go ahead with the next procedure in modern rice milling systems.

Talking about the amount of paddy actually depends on different thing including the efficiency of the husker and it should not be more than 10%. Paddy separators work in a great way making the entire procedure easier and smooth.

Paddy Rice is fed to the **paddy separator in rice mills**. **Paddy** rice is separated from brown rice and the separated **paddy** rice will then be removed.It also called “rice residue”.

Whitening or Polishing

Do you know that how whitening or polishing rich are made? Here, we are going to talk about rice whitening process in modern rice mill.

Actually, white rice is produced removing the bran layer and then germ from the paddy. Now, you might be thinking that how does bran layer is removed. To put in simple words, the bran layer is removed from the kernel going with the different policies such as abrasive or friction polishers. The amount of bran removed is normally between 8 and 10% of the total paddy weight.

Separation of white rice

and the next on the list is all about separation of white rice. Once rice polishing is done, white rice is separated into head rice, small, broken and large rice.

Head rice is generally categorized as Kernels having ration of 75-80o or more of a whole kernel. In order to have a higher degree of precision for grading and separation a length or indent grader is used.

Rice mixing

Talking about a good *modern age rice mill*, it generally produced 50−60%

- Head rice (whole kernels),
- 5−10% large broken
- 10−15% small broken kernels

Moreover, it also depends on country standards as well as what is all about the rice grades in the market as it will contain from 5−25% broken kernels. If rice mixing is get done in a sophisticated manner then a volumetric mixer is necessary.

Mist polishing

It is all about mixing a fine mist of water having dust retained on the whitened rice in order to improve the luster of rice. The motto is not compromising with the quality of rice. A friction type of whitening machine plays a major role to deliver a fine mist of water during the final whitening process ideal for “*final” polishing before the sale*.

Rice weighing

Now, it is time to know about rice weighing. To put in simple words, rice is normally sold in 50 kg sacks and it should be weight accurately and labeled. These days, most rice mills are preferring to go with the advanced manual mechanical weighing system, so that they can have accurate results. This fast electronic system is considered ideal to go ahead.

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