



Unit 5 – Topic 1

Paddy Processing, parboiling of paddy – methods – merits and demerits,

Processing of Rice

Once the plants have reached full growth (approximately three months after planting) and the grains begin to ripen—the tops begin to droop and the stem yellows—the water is drained from the fields. As the fields dry, the grains ripen further and harvesting is commenced. After harvesting rice, it is transferred to the processing plant where the following steps are carried out.

Cleaning

Essential for removal of undesired foreign matter, paddy cleaning is given utmost importance to ensure proper functioning of the Rice Milling machinery. Rough rice is passed through a series of sieves and closed circuit aspiration system is provided to remove dust and light impurities through positive air suction. Undesired material, heavier than rough rice (but of similar size) is removed through a de-stoner/gravity separator. This machine works on the principle of specific gravity. Stones and other heavy impurities, being heavier, stay on the screen surface whereas rough rice, being lighter, fluidizes into the positive air gradient created by an external source.

Drying

Before milling, rice grains must be dried in order to decrease the moisture content to between 18-22%. This is done with artificially heated air or, more often, with the help of naturally occurring sunshine. Rice grains are left on racks in fields to dry out naturally. Once dried, the rice grain, now called rough rice, is ready for processing.

Hulling

1] Hulling can be done by hand by rolling or grinding the rough rice between stones. However, more often it is processed at a mill with the help of automated processes. The rough rice is first cleaned by passing through a number of sieves that sift out the debris. Blown air removes top matter.

2] Once clean, the rice is hulled by a machine that mimics the action of the handheld stones. The shelling machine loosens the hulls from the rice by rolling them between two sheets of metal coated with abrasives. 80-90% of the kernel hulls are removed during this process.



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3] 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. Hulled rice grains are known as brown rice.

Milling

Since it retains the outer bran layers of the rice grain, brown rice needs no other processing. However along with added vitamins and minerals, the bran layers also contain oil that makes brown rice spoil faster than milled white rice. That is one of the reasons why brown rice is milled further to create a more visually appealing white rice.

- The brown rice runs through two huller machines that remove the outer bran layers from the grain. With the grains pressed against the inner wall of the huller and a spinning core, the bran layers are rubbed off. The core and inner wall move closer for the second hulling, ensuring removal of all bran layers.
- The now light-colored grain is cooled and polished by a brush machine.
- The smooth white rice is conveyed to a brewer's reel, where over a wire mesh screen broken kernels are sifted out. Oftentimes, the polished white rice is then coated with glucose to increase luster.

Rice Whitening

Brown rice is rubbed with a rough surface, created using emery stones of specific grid size. The rough emery removes off the brown bran layer. The radial velocity of the stone wheels, grid size of the stones, clearance between stone surface & the other screen and the external pressure on the outlet chamber of the whitening machines determine the extent of whiteness. The bran layer removed from the surface if pneumatically conveyed to a separate room for further processing /storage.

Polishing

The surface of whitened rice is still rough and is smoothened by a humidified rice polisher. The process involves rubbing of rice surface against another rice surface with mystified air acting as lubricant between the two surfaces. Usually a modified version of this process is used to produce superfine silky finish on rice surface. The bran layer removed from the surface if pneumatically conveyed to a separate room for further processing/storage.



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Grading

Broken rice is removed from whole rice by passing the lot through a cylindrical indented screen rotating at a particular speed. The broken/small grains, fit into the indents of the rotating cylinder, are lifted by centrifugal force and gravitational pull falls the grains into a trough. Adjusting the rotational speed and angle of trough can vary the average length of grains.

Sorting

Discoloured rice grains are removed off from the like coloured grains by Rice colour sorting machines. Photo sensors/CCD (Charged Coupled Device) sensors generate voltage signal on viewing discoloured grains, which are then removed off by air jet generated through solenoid valves.

Enriching

The milling process that produces white rice also removes much of the vitamins and minerals found primarily in the outer bran layers. Further processing is often done in order to restore the nutrients to the grain. Once complete, the rice is called converted rice.

- White rice is converted in one of two ways. Prior to milling, the rice is steeped under pressure in order to transfer all the vitamins and minerals from the bran layers to the kernel itself. Once done, the rice is steamed, dried, and then milled. Rice that has already been milled can be submersed in a vitamin and mineral bath that coats the grains. Once soaked, they are dried and mixed with unconverted rice.

Packing

The finished product is then packed and is stored to be delivered to valued customers.

PARBOILING OF PADDY – METHODS – MERITS AND DEMERITS

Parboiling is a process used in the rice milling industry to partially precook paddy rice before milling. This process involves soaking, steaming, and drying the paddy, and it has several merits and demerits. Here's an overview:

Methods of Parboiling:

1. Traditional Soaking Method:

- Paddy is soaked in water for a few hours or overnight to allow the water to penetrate the grains. After soaking, the paddy is steamed, and then it undergoes drying and milling.



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2. Soaking in Hot Water Method:

- Paddy is soaked in hot water for a shorter duration compared to the traditional method. This method reduces the soaking time and facilitates better heat penetration during steaming.

3. Continuous Parboiling System:

- In industrial settings, continuous parboiling systems are often used. Paddy moves through various stages of soaking, steaming, and drying on a conveyor system.

Merits of Parboiling:

1. Nutrient Retention:

- Parboiling helps retain nutrients in the rice grains, particularly in the bran layer. This is because the process drives some of the nutrients from the bran into the endosperm.

2. Reduced Breakage:

- Parboiling improves the physical properties of rice, making it less prone to breakage during milling. This results in a higher milling yield.

3. Enhanced Milling Quality:

- Parboiled rice tends to have a better appearance, texture, and cooking quality compared to non-parboiled rice.

4. Extended Shelf Life:

- Parboiling contributes to the stabilization of rice, leading to a longer shelf life. The process minimizes the risk of insect infestation and improves the keeping quality of the rice.

5. Improved Cooking Properties:

- Parboiled rice often cooks faster and absorbs less water than non-parboiled rice. It tends to be less sticky and has a firmer texture.

6. Reduction of Post-Harvest Losses:

- Parboiling helps reduce post-harvest losses by enhancing the resistance of rice to insect attacks and microbial spoilage.

Demerits of Parboiling:

1. Energy Consumption:

- The parboiling process requires energy, especially for steaming. This can contribute to higher production costs, particularly in regions where energy is expensive.

2. Water Usage:



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- The traditional parboiling process involves soaking the paddy in water, which can be a concern in regions facing water scarcity or where water conservation is essential.

3. Complexity:

- The parboiling process can be complex, involving multiple steps. Managing and maintaining the equipment for parboiling may require skilled operators.

4. Initial Investment:

- Establishing a parboiling facility requires initial capital investment in equipment and infrastructure. This can be a barrier for small-scale rice millers.

5. Color Changes:

- While parboiling improves the color of some rice varieties, it may result in undesirable color changes for others.

Despite these demerits, parboiling remains a popular method in many rice-producing regions due to the overall improvement in rice quality and nutritional value. Advances in technology have also led to more energy-efficient parboiling methods, addressing some of the concerns associated with traditional processes.