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Milling is a crucial step in post-production of rice. The basic objective of a rice milling system is to remove the husk and the bran layers, and produce an edible, white rice kernel that is sufficiently milled and free of impurities. Depending on the requirements of the customer, the rice should have a minimum number of broken kernels. A rice milling system can be a simple one or two step process, or a multi stage process. One step milling -husk and bran removal are done in one pass Two step process -removing husk and removing bran are done separately Multistage milling -can be done in the village or local consumption or commercially for marketing rice;rice undergoes a number of different processing steps, such as: Pre-cleaning Dehusking or dehulling Paddy separation Whitening or polishing Grading and separation of white rice Mixing Mist polishing Weighing of rice The best quality rice will be attained if the quality of paddy is good and the rice is milled properly.To improve the quality of the rice, factors such as the paddy quality and milling technology should be considered. To obtain good paddy quality: Mill at the right moisture content (MC)A moisture content of 14% MC is ideal for milling.If the MC is too low, high grain breakage will occur resulting in low head rice recovery. Broken grain has only half the market value of head rice.Use a moisture meter to determine the moisture content. Visual methods are not accurate enough.Read:Moisture content for milling Pre-clean paddy before huskingUse of paddy without impurities will ensure a cleaner and higher quality end product. Do not mix varieties prior to millingDifferent varieties of paddy have different milling characteristics that require individual mill settings. Mixing varieties will generally lead to lower quality of milled rice. Read: Producing good quality milled rice When using milling technology: Use rubber roll technology for huskingRubber roll huskers produce the best quality. Engleberg-type or "steel" hullers are no longer acceptable in the commercial rice milling sector, as they lead to low milling recovery and high grain breakage. Use a paddy separatorSeparate all paddy from the brown rice before whitening. Paddy separation after husking will lead to better quality milled rice, and reduce overall wear and tear on the rice mill. Consider two-stage whiteningHaving at least two stages in the whitening process (and a separate polisher) will reduce overheating of the grain and will allow the operator to set individual machine settings for each step. This will ensure higher milling and head rice recovery. Grade the milled riceInstall a screen sifter to remove small broken and chips from the polished rice. Rice with a large number of small broken (or brewers rice) has a lower market value. The small broken can be utilized to produce rice flour. Monitor and replace spare parts regularlyTurning or replacing rubber rolls, refacing stones, and replacing worn screens regularly will keep milled rice quality high at all times. A rice milling system can be a simple one or two step process, or a multi stage process. Read more The main by-products of rice are rice husk or hull, rice bran, and brewers rice. Read more Different moisture contents are required per postproduction operation. These should be followed to ensure good quality of paddy. Read more To produce quality milled rice, the paddy should be good, equipment well maintained, and the operator should have appropriate skills Read more The IRRI Rice Quality Assessment Kit consists of a set of various tools that help measuring one or several paddy, milled rice or seed quality traits. Read more A rice milling system can be a simple one or two step process, or a multi stage process. In a one step milling process, husk and bran removal are done in one pass and milled or white rice is produced directly out of paddy. In a two step process, removing husk and removing bran are done separately, and brown rice is produced as an intermediate product. In multistage milling, rice will undergo a number of different processing steps. Depending on whether the the paddy is milled in the village for local consumption or for the marketing rice milling systems can be classified into two categories: (1) village rice mills and (2) commercial mills. Photo: Husking with mortar and pestle Village-type rice mills can be found in rural communities and are used for service milling paddy of farmers for home consumption. Traditional milling Hand pounding of paddy in a mortar with a pestle is the traditional milling process in remote villages. Pounding the paddy induces upward and downward forces on grain against grain that removes the husk and bran layers. The pounding also breaks up fissured grain. The final cleaning is by winnowing in a woven bamboo tray. The winnowing process to separate unmilled paddy grain is an art. Village level rice mills Village-type rice mills can be found in rural communities and are used for service milling paddy of farmers for home consumption. Single pass, single stage mill Photo: Single stage, single pass mill The single pass rice mill is an adaptation of the "Engleberg" coffee huller from the United States, modified for milling rice. In earlier days this type of rice mill was very popular in most rice-growing countries. It is still the mainstay technology for milling parboiled paddy in Bangladesh, and in many African countries. The "iron hullers", or "single pass mills" which all refer to the same mill are notorious for breaking the paddygrain. Because of the high breakage, the total milled rice recovery is 53-55%, and head rice recovery is in the order of 30% of the milled rice. The fine broken are mixed with the bran and the ground rice hull. This by-product is used for animal feed. In many rural areas, Engleberg mills are used for custom milling the rice requirements of households.The bran produced is left to the miller as the milling fee. The poor performance of the Engleberg mill has led governments to discourage its use and has limited further proliferation. In many Asian countries, Engleberg mills can no longer be licensed to operate as service or commercial mills. Photo: Single stage, single pass micro mill The Micro mill is also a single pass single stage mill, which was designed for local production. All components can be produced by local welding workshops. However, the milling recovery and head rice recovery is quite low and it is therefore only suitable for milling paddy for home consumption in very remote areas where the farmers dont have access to a custom rice mill. Two stage mills (single pass or two pass) Two stage milling is either done in compact 2-stage rice mills, or with two separate machines for husking and polishing. Typically they have 0.5 to 1 ton per hour paddy input capacity. They are also used for custom milling services in the rural areas. A typical compact rice mill consists of a 6-inch diameter x 6-inch wide rubber roller husker, and a friction whitener. The friction whitener has a very similar design configuration as the Engleberg except that it has no husking knife. The milling performance of the compact rice mill is superior to the single pass Engleberg huller. Milling recoveries are normally above 60%. Photos: Compact rice mill, schematic diagram (left) with rubber roller on top and steel polisher on the bottom, compact rice mill in Indonesia (right) Photo: Two separate machines for two stage, two pass milling with rubber roller husker on the left and a steel polisher on the right. Mobile rice mills Photo: Mobile Rice Mill in Cambodia with rubber roller husker on the right and polisher on the left. A recent development are mobile rice mills. These typically consist either of two stage, single pass mills, or alternatively a huller and a polisher mounted on a self propelled vehicle. These mobile mills can be seen in Vietnam, Cambodia, Indonesia and the Philippines. The mill comes to the customer, who does not have to transport his paddy to the mill and the milled rice back. Commercial milling systems mill the paddy in stages, and hence are called multi-stage or multi-pass rice mills. The objective of commercial rice milling is to reduce mechanical stresses and heat buildup in the grain, thereby minimizing grain breakage and producing uniformly polished grain. Compared to village-level systems, the commercial milling system is a more sophisticated system configured to maximize the process of producing well-milled, whole grains. The rice milling facility comes in various configurations, and the milling components vary in design and performance. Configuration refers to how the components are sequenced. The flow diagram below shows a modern commercial mill catering to the higher end market. It has three basic stages, the husking stage, the whitening-polishing stage, and the grading, blending, and packaging stage. In modern rice mills, many adjustments (e.g. rubber roll clearance, separator bed inclination, feed rates) are automated for maximum efficiency and ease of operation. The whitener-polishers are provided with gauges that sense the current load on the motor drives which gives an indication of the operating pressure on the grain. This provides a more objective means of setting milling pressures on the grain. Objective of commercial milling A commercial rice miller will have following objectives: produce edible rice that appeals to the customer - i.e. rice that is sufficiently milled and free of husks, stones, and other non-grain materials maximize the total milled rice recovery out of paddyand minimize grain breakage Types of commercial mills Traditional commercial mills also consist of different pieces of equipment for the three stages outlined above. They are often made from wood with few metal components and are often driven by a single power source through a system of transmissions. Building such traditional mills was almost considered an art rather than engineering. Modern commercial milling lines are fully automated and usually consist of one or more components for each stage of the milling process. The modern rice milling process Modern rice milling processes consist of: Stage Function Pre-cleaning removing all impurities and unfilled grains from the paddy Husking removing the husk from the paddy Husk aspiration separating the husk from the brown rice/unhusked paddy Paddy separation separating the unhusked paddy from the brown rice De-stoning separating small stones from the brown rice Whitening removing all or part of the branlayer and germ from the brown rice Polishing improving the appearance of milled rice by removing remaining ran particles and by polishing the exterior of the milled kernel Sifting separating small impurities or chips from the milled rice Length grading separating small and large broken from the head rice Blending mix head rice with predetermined amount of broken, as required by the customer Weighing and bagging preparing milled rice for transport to the customer Flow diagram of a modern rice mill The flow diagram below represents the configuration and flow in a typical modern rice mill (using the IRRI rice mill as an example). Description of flow of materials and processes 1paddy is dumped in the intake pit feeding the pre-cleaner Astraw, chaff and empty grains are removed2pre-cleaned paddy moves to the rubber roll husker: Bhusk removed by the aspirator3mixture of brown rice and unhusked paddy moves to the separator4unhusked paddy is separated and returned to the rubber roll husker5brown rice moves to the destoner 6small stones, mud balls etc. removed by de-stoner7de-stoned, brown rice moves to the 1st stage (abrasive) whitener7partially milled rice moves to the 2nd stage (friction) whitener 8Coarse (from 1st whitener) and fine (from 2nd whitener) bran removed from the rice grain9during the whitening process8milled rice moves to the sifter 9Small broken/brewers rice removed by the sifter10(for simple rice mill) ungraded, milled rice moves to bagging station11(for more sophisticated mill) milled rice moves to the polisher11Polished rice, will move to length grader11Head rice moves to head rice bin12broken moves to broken bin13Pre-selected amount of head rice and broken moves to blending station14Custom-made blend of head rice and broken moves to bagging station15Bagged Rice moves to the market Examples for outputs from the different stages Clean paddy after pre-cleaning Paddy grain after pre-cleaning. Poor quality grain is evident from its darker color. These are immature kernels or half filled grains that are not removed in the pre-cleaner. The presence of poor quality grain lowers the total milling recovery. Brown rice at the rubber roller husker Mixture of paddy grain and brown rice coming out of the rubber roll husker. With uniform size paddy, about 90% of the paddy should be husked after the first pass. This mixture goes through a paddy separator, after which the paddy is returned to the husker, and the brown rice goes to a de-stoner. Milled rice after polisher Milled rice after the 2nd stage friction polisher. Small broken grains are still evident. This product goes to a sifter to remove the small broken grains. Note: Most mills have several polishing stages for gentle milling. In those mills there is undermilled rice after the 1st stage friction whitener. Not all the bran layers are fully stripped. In times of rice shortage, production of undermilled rice is promoted because of the higher milling recovery. Brewers rice from the sifter Brewers rice or small broken grains removed by the screen sifter. Rice milling in modern age is the combination of several commercial milling operations that produce better quality white rice from rough rice (Rice Paddy). Modern Rice Milling ProcessesMilled Riceis being produced, in Rice mills, after removing bran, husk and germ. Rice produced after modern rice milling process has different flavor, appearance ( white) 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 stepsIn an ideal milling process this will result in 20% husk, 812% bran depending on the milling degree and 6872% milled rice or white rice depending on the variety.Modern Rice Milling flow chartModern Rice Mill Process Flow ChartLets discuss rice mill functioning and steps in rice milling processes from pre-cleaning to packaging for sale.Rice Pre-cleaning Processraw paddy cleaning in modern rice millsPaddy 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 separationPaddy 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.Paddyrice is separated from brown rice and the separatedpaddy rice will then be removed.It also called rice residue. Whitening or PolishingDo 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 riceand 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 75-800 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 mixingTalking about a good modern age rice mill, it generally produced 5060%Head rice (whole kernels),510% large broken1015% small broken kernelsMoreover, it also depends on country standards as well as what is all about the rice grades in the market as it will contain from 525% broken kernels. If rice mixing is get done in a sophisticated manner then a volumetric mixer is necessary.Mist polishingIt 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 weighingNow, 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.To make more profit, it is needed to make sure that you are going to have advanced machinery at your work to gain amazing results in rice milling operations.Looking for Rice Whitening Stone, Rice Polisher ?Contact Us What is the purpose of rice polishing in modern rice milling? Rice polishing removes the bran layer and germ from brown rice to produce white rice, enhancing its appearance and texture. This step helps improve the rices shelf life, giving it a smooth, shiny finish while preserving its flavor and quality. How is broken rice separated from whole kernels in the milling process? After whitening, rice is separated into head rice (whole kernels) and broken rice using grading equipment. This is usually done with a length or indent grader, which ensures accurate separation based on size, allowing for higher-quality rice to be sold while broken grains are categorized for other uses. Why is pre-cleaning raw paddy so important before modern rice milling begins? Pre-cleaning is crucial because raw paddy often contains impurities like stones, straw, soil, and weed seeds that can damage milling machinery and reduce efficiency. Removing these foreign materials before hulling protects the equipment, improves milling performance, and ensures higher-quality rice output. Skipping this step can lead to frequent breakdowns and lower overall yield. The objective of a rice milling system is to remove the husk and the bran layers from paddy rice to produce whole white rice kernels that are sufficiently milled, free of impurities and contain a minimum number of broken kernels . This article mainly introduce the rice milling machine s development and how rice milling machine work. Rice mill processing line design Rice milling is the process of removing the husk and bran layer to produce white rice. the rice milling machine s development and how rice milling machine work can be undertaken as: 1) A one step milling process where the husk and the bran are removed in one pass and white rice is produced directly from the paddy. 2) A two-step process where the husk and the bran are removed separately, and brown rice is produced as an intermediate product. 3) A multistage process where rice passes through a number of different operations and machines from paddy to white rice. Horizontal rice whitener The development of rice milling machine and how rice milling machine work: The traditional rice milling machine work by manual. One pass milling Pestle and mortar Hand pounding of paddy in a mortar wit a pestle is still practiced in some remote areas. Pounding the paddy induces upward and downward forces on grain against grain that removes the husk and some bran layers. Then use the steel single pass mill. This type of mill is still very popular in many of the poorer rice-growing countries and is widely used for custom milling of household rice. It is also still popular for milling parboiled rice in Bangladesh and many African countries. But this type mill with a lower yield of rice. Two stage mills, Which mainly used for smaller capacity paddy processing. Rice mill processing line The two-stage mill has separate hulling and polishing processes. Rubber rollers remove the husk and the brown rice is then polished with a steel friction whitener similar to the Engleberg. These mills have a capacity of between 0.5 to 1 ton per hour paddy input and are often used for custom milling in the rural areas. The milling performance of the compact rice mill is superior to the single pass Engleberg huller with milling recoveries normally above 60%. Now, mostly of the rice milling machine is multiple pass rice milling, Which is also a commercial Mill The milling process in larger commercial mills combines a number of operations that produces higher quality and higher yields of white rice from paddy or rough rice. Rice polisher The rice milling machine working process involves: 1. Pre-cleaning the paddy prior to milling 2. Removing the husk or outer layer from the paddy 3. Rice milling section 4. Polishing or whiting the brown rice to remove the bran layer 5. Separating the broken grains from the whole kernels 6. Color Sorting 7. Bagging the milled rice 8. Managing the by-products,mainly for fuel of steam boiler or stove. Advanced rice milling machine will improve the rice yield and decrease the broken rice rate, which is more and more popular by many developing countries, if you are in interested in rice milling machine, please contact us directly. Moisture content (MC) is the weight of water contained in paddy or rice expressed in percent. MC is usually referred to the wet basis meaning the total weight of the grain including the water (MCwb). For research moisture content referred to the dry matter of the grain is sometimes used (MCdb). Why is measuring the moisture content important? Accurate moisture content testing is important in managing and marketing paddy and rice because depending on the purpose rice has different ideal moisture contents. Inaccurate moisture content measurements lead to: Extra drying cost and harvesting loss if paddy is harvested wetter than necessary Spoilage if the grain is too wet in storage Extra drying cost and loss of quality if paddy is dried too far Lower head rice when milled at wrong MC Weight loss (loss in profit) if grain is sold too dry How to measure moisture content Moisture content of grain can be measured by using either: primary method,based on weighing loss like the (a) oven method or an (b) infrared method,using an electronic instrument that uses electrical characteristics of the grains. Many different types of portable grain moisture meters can be used to measure the moisture content. When selecting a meter, make sure it is suitable for harvesting paddy or milling grain, depending on which activity you are doing. Read: Types of portable moisture meters Higher moisture content results in more losses from poor grain quality; while, lower moisture content results in more losses from shattering. For measuring moisture content during harvesting, the most practical option is to use a resistance-type moisture meter that gives quick results and only uses small samples. The capacitive moisture meters are more expensive, require a larger sample, but are more accurate than resistance type units. Grains should be dried to a certain moisture content (MC) depending on storage period to avoid potential problems: Storage period Required MC for safe storage Potential problems weeks to a few months 14% or less molds,discoloration,respiration lossinsect damage, moisture adsorption 812 months 13% or less insect damage storage of farmer's seeds 12% or less loss of germination