

**PROCESSING  
TECHNOLOGY OF CEREALS  
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# **PADDY PARBOILING**

# INTRODUCTION

- Parboiling is a hydrothermal treatment followed by drying before milling for the production of milled parboiled grain.
- Paddy grain is mainly composed of endosperm which is mainly filled with the starch granules. The voids and intracellular spaces are filled with air and moisture, responsible for the breakage of rice during the milling. This may be avoided by gelatinising the starch which fill up the voids and cracks. This is called parboiling of paddy.

**Advantages.** Advantages of parboiling the paddy are :

1. The extra strength acquired by rice kernels during the parboiling helps in minimizing the broken to a considerable extent. This increases the milling yield.
2. Due to splitting of husk in the process of parboiling the shelling of parboiled paddy becomes easier.
3. Parboiled rice retains more proteins, vitamins and minerals.
4. During cooking, loss of solids in gruel is less. Also, after cooking, the rice absorbs less fat from added condiments, the rice keeps longer and does not become rancid easily.
5. Parboiled rice withstand overcooking without becoming pasty.
6. Rice bran from the parboiled rice is of superior quality as it get stabilize during the process which can yield oil of edible grade. Also, it contains about 25 to 30% oil whereas raw rice bran contains only 15 to 20% oil.
7. Due to its acquired hardness, parboiled rice is more resistant to insect infestation during the storage.
8. The shelf life of parboiled paddy and milled parboiled rice is longer than in the raw state.

**Disadvantages.** Disadvantages of parboiling the paddy are,

1. Parboiled rice takes more time to cook and may have a characteristics flavour and colour which is dislike by many raw rice eaters.
2. The heat treatment during the parboiling destroys some natural antioxidants, hence rancidity developed in parboiled rice during storage is more than that in raw rice.
3. The presence of high moisture (35%) in parboiled paddy for a long time may cause the development of mycotoxins in rice which are hazardous to human health.
4. It needs extra investment and also adds in drying cost to total processing cost.
5. It is more difficult to whiten the parboiled rice resulting in lower mill throughput capacity and increases milling power. This increases milling cost. Moreover, it also chokes the whitener due to higher oil content.

# PHYSICO-CHEMICAL CHANGES DURING PARBOILING

- Gelatinisation of starch and disintegration of protein bodies in the endosperm.
- The starch and protein expand and fill the internal air spaces. The fissures and cracks in the endosperm are sealed making the grain translucent and hard as a result of which the breakage of grain during milling is minimized.
- The colour of the rice changes to yellow or yellowish brown.
- Parboiled rice takes a longer time to cook to the same degree of softness than raw rice of the same variety.
- The loss of protein and starch from parboiled rice in the cooking water is low.
- The presence of vitamin E is particularly noted in parboiled rice.
- The heat treatment during parboiling causes destruction of some natural antioxidants and may result in increased rancidity of parboiled rice during storage.

- In general, the three major steps in parboiling, i.e, soaking, steaming and drying,
- Soaking of paddy is done at or below the gelatinisation temperature. The lower the temperature the slower is the process of soaking and vice versa.
- Steaming helps in the gelatinisation of starch in the paddy. The higher the temperature of steam and longer the steaming time, the harder is the rice and darker the colour.
- Drying of parboiled paddy may be done in the shade, in the sun, or with hot air. Shade drying takes a longer time but results in excellent milling quality. Rapid drying in the sun or with hot air causes higher breakage during milling.

- In continuous drying, breakage starts as the moisture content reaches about 18 per cent and increases rapidly with further drying. Hence the recommended practice would be to dry in two passes with a tempering in between at about a moisture content of 20 per cent.
- Normally, the varieties of paddy which are more brittle are preferred for parboiling.
- The long and slender varieties which are more fragile compared with short and medium length grains are usually parboiled.
- Scented and tiny varieties which have good milling quality are generally not parboiled.



# SOAKING

- The process of water absorption is known as soaking, steeping or imbibation. It is a diffusion process.
- Soaking is the result of molecular absorption, capillary absorption and hydration.
- Soaking is done to provide the starch with a quantity of water sufficient for gelatinisation.
- The rate of soaking is high initially but it decreases with time until bursting of the grain takes place when the soaking rate increases particularly at the temperature of gelatinisation and higher.

- The soaking continues till the paddy reaches a moisture content of 24-45 per cent depending upon soaking temperature.
- The gelatinisation temperatures are normally within 65-75°C.
- In some modern processes vacuum and hydrostatic pressure are used to reduce soaking time, keeping the temperature within desirable limits.



# STEAMING

- Steam is used to complete the gelatinisation process.
- During steaming the spread of the water soluble substances inside the paddy grain which is begun during soaking is continued and increased.
- The granular texture of endosperm becomes pasty due to gelatinisation.
- Any crack in the scutellum is sealed.
- The endosperm becomes compact and translucent.
- Most of the biological processes are completely annihilated and the enzymes are also inactivated.
- Big increase in volume occurs between steam temperature of 100-120°C.

# DRYING

- The parboiled paddy is required to be dried to a moisture of 14-16 per cent to obtain the desirable milling and storing properties.
- The paddy is dried to a moisture of about 18-20 per cent and then heaped and tempered for few hours and then again dried for 1-2 hrs to bring down the moisture to 14-16 per cent.





# ASSIGNMENT

- Why the soaking rate increases as the temperature increases?
- Why the parboiled rice is said to have high nutritive value?
- Name some varieties of paddy subjected to parboiling.