

## Chapter-I

### SOME STUDIES ON DRYING OF PARBOILED PADDY

#### Introduction :

Parboiling of paddy is a good old practice followed in India from times immemorial. Nearly half of Indian population take parboiled rice. Of the 64 million tonnes of paddy produced in India, more than half of it is parboiled. The importance of parboiled rice is receiving greater attention in many circles of people due to many advantages over raw rice. Parboiling of paddy will give 5 to 6 per cent more outturn of rice when compared to raw paddy which is very significant. By parboiling the paddy, the breakage of rice during milling reduces to minimum which means a tremendous cutdown of the wastage. It is estimated that if all the rice produced in India were parboiled, there could be net saving of one million tonnes of rice annually, if not more and the economic aspects of trade pattern of rice could undergo favourable alteration. For this reason, Government of India has started giving incentive to rice millers for making parboiled rice.

Parboiling is a premilling treatment of partial boiling of paddy within its husk. It is basically a heat treatment of paddy by passing steam through paddy at elevated moisture content of 30% wet basis. Parboiling process consists of mainly three steps, first soaking the paddy in the cold or hot water to increase the moisture content, second heat treatment of paddy by introducing steam into it and third drying the paddy in the Sun or by mechanical

means. By parboiling, the rice grain gains extra strength and can withstand harder milling processes than the raw paddy. Therefore, parboiled paddy on milling yields more outturn with minimum breakage. The germ of the rice grain remains intact with the kernel. Some of the other advantages of parboiling are better taste to some people, better cooking quality, longer storability with lesser attack by insects. Loss of solids in the form of gruel during cooking is less and parboiled rice cooks into rubbery and nonpasty grains. In addition to these, bran from parboiled rice contains more oil with low free fatty acid content and therefore fetches more price than the bran from raw rice.

Most of the parboiled paddy produced by traditional method is sundried to bring the moisture content from 35% to 14% for milling purpose. Sun energy is freely available in abundance in this country except during the rainy season. The reasons for the practice of sun-drying are lower investment, labour oriented practice and provides jobs for many labour which is relatively cheap and is easily available. Moreover, this method requires no special skill or care and costs very little. But the main limitation of sun-drying of parboiled paddy is that it cannot be practiced in rainy season and cloudy weather. For this very reason, almost all the rice mills associated with parboiling remain closed nearly for six months starting from the month of June. Today many rice millers are eagerly looking for a better, quicker and economic method for drying parboiled paddy, which can be practiced althrough the year round. Some of the limitations of sun-drying are drying is dependent on weather conditions, drying

is not uniform, large area is required and hence this method can not be adopted in large capacity rice mills in the urban areas where cost of land is very high, the labour requirement is high and presents many social problems such as labour agitation problem. Considerable quantity of paddy estimated at about 1% is lost during the drying process which includes losses due to spoilage, birds and rodents, possibility of development of mycotoxins responsible for causing diseases is high and lastly the colour of parboiled rice is considerably affected by the processing conditions.

Mechanical drying is the process utilizing mechanical means for drying grains by blowing natural or heated air through grain mass to accomplish removal of excess moisture from it. Some of the main features of mechanical drying are (i) drying rate can be controlled to produce better quality product (ii) operation can be performed irrespective of weather conditions both in day and night (iii) the process is automatic and requires minimum labour (iv) losses due to birds and rodents are eliminated (v) it requires very little space for operation (vi) large amounts of grain can be handled in shorter times since drying rate is faster. To eliminate some of the disadvantages mentioned in sun-drying, mechanical dryers were introduced in India a decade ago. At the same time, in order to improve the quality of parboiled rice, research work was taken up at Jadavpur University, Calcutta and Central Food & Technological Research Institute, Mysore. Both these Institutes have developed

almost identical improved(modern) parboiling methods but have recommended different drying techniques for drying parboiled paddy. The method developed by CFTRI has become more popular but it is found that the cost of parboiling and drying the paddy by this method is excessively high and the process becomes uneconomical. Few private and cooperative rice millers are operating Louisiana State University type dryers in India on the basis of personal experience and available information about the rating of different parameters like temperature, air flow rate of drying air, duration of drying pass and tempering time. Some people are of the opinion that tempering is essential for drying parboiled paddy and others suggest that it is not necessary.

The problem "some studies on drying of parboiled paddy" was taken up in order to study the effect of these parameters on the drying rate and milling quality of paddy and to design and develop an efficient economical mechanical dryer with suitable recommendations to operate it. During middle of 60's, a team of experts of the Ford Foundation visualized the need of modernising the rice processing methods/techniques practiced in India with a view to conserve the rice grown in the country by the elimination of the various losses occurring at different stages of handling and processing from harvesting paddy onwards. The team suggested in regard to processing of paddy, among others, that modern method of parboiling of paddy i.e. improved parboiling method developed by CFTRI known as CFTRI Method, along with the mechanical dryer developed by Louisiana State University may be adopted in lieu

of the existing conventional parboiling units. They envisaged that these modern parboiling unit would not only give parboiled rice of better quality by elimination of malodour (off flavour) and toxic residue but also give an increased outturn of parboiled rice by eradication of the losses of paddy while sun-drying in open yards occuring due to predation of cattle, birds and rodents. It is after this the Govt. of India introduced the modern techniques of parboiling in few cooperative rice mills and in some Government rice mills. As per today, mostly LSU type dryers coupled with furnace oil heat exchangers are in use for drying parboiled paddy. With these dryers very high cost of drying (Rs.50.0 per tonne of paddy ) and various operational troubles have been the major drawbacks. The present practice of drying parboiled paddy is to blow hot air through the paddy at 120°C, while paddy is recirculated in the dryer by an elevator till the paddy moisture content drops to the desired level. The rice obtained by this practice was found to be dark in colour and few grains were heat da-maged. It is an expensive method due to higher losses of heat in the exhaust air and larger amount of fuel used for drying air. The expert committee appointed by the National Cooperative Development Corporation to make technoeconomic study and to examine the feasibility of modern parboiling and drying methods have reported that the cost of drying parboiled paddy could be reduced tremendously by operating the mechanical dryer properly. They reported that intensive research work should be carried out to design an economical and efficient

dryer and to find optimum drying conditions. They felt that there is lot of scope to do further improvement in this area and it should be given immediate attention.

" Modern parboiling and drying plants require huge investment, cost of parboiling and drying by modern method is very high " is the opinion of progressive rice millers who are willing to modernize the parboiling process. This criticism of the modern system and its cost feasibility has been the single biggest deterrent in modernization of parboiling and drying units in the country. This does not mean that the entire blame should go to CFTRI method or to LSU type dryer. Numerous trials in laboratory and commercial level have established that the CFTRI process as a whole is very effective in producing good quality parboiled paddy. However, the system analysis of the modern plant with respect to size, sequence of operations and the optimum drying conditions have to be made. Maximum use of the plant machineries and proper matching of individual processing units in plant with one another are the most important factors in running the plant efficiently and economically. This indicates that the information available on mechanical drying of parboiled paddy is very much limited and the existing practice needs considerable modification. With this in view, the problem of drying parboiled paddy is taken up to get information on drying conditions. The following are the specific objectives.

- 1 Study the effect of drying air temperature, air flow rate, tempering period on the total drying time and

milling quality of parboiled paddy in the laboratory,

- 2 design, development and testing of a suitable small size efficient dryer for drying parboiled paddy,
- 3 design and layout of modern parboiling and drying plants of optimal size to match a given capacity rice mill with minimum idle time of machines and better utilization and higher efficiency of the system.