CHAPTER I

INTRODUCTION

Rice is one of the most important agricultural crops in the world and particularly Asian countries where rice is a major staple food. In Thailand rice is the most important crop and the production of rough rice and yield per area during crop year 1983/1984 are 19.55 million tons and 2.04 ton per hectare, respectively.

Rough rice, a living organism which is hygroscopic in nature, gains or looses moisture when vapour pressure of water outside the grain is higher or lower than that inside the grain. It is different from other grains because it has an outer husk cover and a bran layer present during drying and storage. Therefore the heat and mass transfer in rice is different from other cereal grains.

Harvesting rough rice with high moisture content ranging from 20-22 % wet basis (w.b.) normally results in high yields, less damage and prevents field losses due to dropping and shattering,but it is too high for safe storage. Therefore, rough rice must be dried to approximately 13 % to 15 % moisture content (w.b.) for storage. Fissures and high temperature gradient will be developed if the rough rice has a high moisture content. Fissures lead to broken grains during milling, reducing the milled rice yield. Research on rice drying is imperative in order to meet the drying needs of increased rice production and to dry rice efficiently.

The problem of drying is of great importance. In general the drying rate can be increased by using higher air temperatures. However, high temperature during drying causes some grain quality problems. It causes cracks in the rice kernel which reduces the milling quality. Efficient drying of rough rice with minimum damage to the grain is a major concern of the rice industry. It can be improved by the accurate analysis of the drying process. Grain drying processes have been studied by various researchers but few published studies are available on tropical rice varieties under tropical conditions. A deep-bed grain drying process will be based on the assumption that the bed is composed of a series of thin-layers. The exhaust air condition from a thin-layer is treated as the input air conditions of the above layer. By using a mathematical and computer simulation, the moisture and temperature profile in a deep-bed grain drying process can be predicted. The validity of deep bed models will directly depend on how well the thin-layer drying equation in the model describes the thin layer process. For this purpose, the generalized thin-layer rough rice drying models should be developed. The models must be suitable for use at any drying air condition; temperature, relative humidity, flow rate and at any initial moisture content of rough rice. The use of simulation to provide a better understanding of the drying process is now firmly established. Clearly, suitably constructed models can be used to help with the design of new driers and to promote the more efficient use of existing driers.

A thin-layer drying process can be divided into two periods : 1) the constant rate drying period, and 2) the falling rate drying period. Cereal grains usually do not exhibit a constant rate drying period unless they are harvested at a very immature state or have had water condensed or deposited on their surfaces. This implies that the drying rate decreases continuously during the interval of drying until the equilibrium moisture content is reached. In this research, various mathematical models will be developed for predicting thin-layer drying rate of long grain rough rice during the falling rate period.

The objectives of the study :

1. To obtain information on the thin layer drying rate of long grain rough rice under various conditions.
2. To develop an empirical thin layer drying model which describes the observed data satisfactorily.
3. To simulate and experimentally verify the deep bed drying using developed thin layer drying model.

The scope of the study :

Thin layer drying tests of long grain rough rice were conducted for each combination of the following parameters :

1. Temperature of drying air (35 - 60°C)
2. Relative humidity of drying air (30 - 70 percent)
3. Initial moisture content of rough rice (20 - 40 percent, dry basis)

Methodology :

1. To design and construct a thin-layer air drying apparatus.
2. To obtain information on the thin layer drying rate of long grain rough rice under various air conditions.
3. To develop various thin-layer drying models for predicting the thin-layer drying rates of long grain rough rice.
4. To select a thin-layer drying model which describes the observed data satisfactorily.
5. To design and construct a deep bed drying apparatus and obtain data on deep bed drying.
6. To use the appropriate thin-layer drying model in a deep bed drying simulation.