CHAPTER IV

DEEP BED DRYING APPARATUS AND EXPERIMENTAL PROCEDURE

4-1 Equipment and measurements

The apparatus used in the deep bed drying experiment is consisted of two major parts namely the air conditioning unit and deep bed drying unit. The same air conditioning unit is used in deep bed drying experiments and in the determination of the drying rate equation for a thin layer of rough rice. The air conditioning unit is connected to the deep bed drying bin. The bin was fabricated from steel plate. The inside cross sectional dimensions of this bin is 0.30 m. x 0.30 m. and 0.60 m. high. The bottom of this bin is fitted with steel net and wire mesh to hold the grain. The column of grain in this bin was considered to consist of 6 layers of rice each being 5 cm. deep. A series of 4 m.m. diameter holes were drilled and thermocouple probes inserted in the holds (Figure 4.1 and 4.2). To sense and record the temperature of each layers, thermocouple probes were connected to a Takeda Riken data logger (Model TR 2721). An additional set of holes of 2 cm. diameter were also drilled to with-draw some samples from each layer (Figure 4.2) to determine average moisture content by the standard oven method (16 hours at 130°C).

4-2 Experimental procedure

Rough rice, RD7 (from 20 kg to 30 kg) was conditioned to the desired moisture content as follows. The grain was divided into small batches of 2 kg. Each batch was sprayed and mixed with a calculated amount of distilled water to bring the moisture content up approximately

to the desired value.   After thoroughly mixing the grain was stored in plastic containers about $5\,^{\circ}C$ for at least 14 days.

Before the start of each drying run, a sample was removed from the refrigerator and placed on the floor in the laboratory to bring the temperature of the rough rice to room temperature. A part of this sample was used in the deep bed drying test and the other was used to check its initial moisture content by standard oven method (16 hours at 130 $^{\circ}C$).   The air conditioning unit was also run at desired conditions of drying air before each experiment begun, so that the temperature, relative humidity and air velocity could become stabilized.

After stabilization, the bin was filled with prepared rough rice.   The temperature of air was measured at various locations as shown in Figure 4.2.   A data logger (Takeda Riken Co.,Ltd, Model TR 2721) was used to record the temperature at each layer continuously during drying.   Rough rice samples for the determination of moisture content by the standard oven method were drawn at each layer and at the end of the drying time.   Each drying run took 6 hours.

Five deep bed drying experiments were conducted using various inlet air conditions and various initial moisture content of rough rice as shown in Table 4.1. Data from the experiment was recorded and showed to compare with output from computer simulation in chapter 7.

Table 4.1   Various test conditions used in deep bed drying
experiments

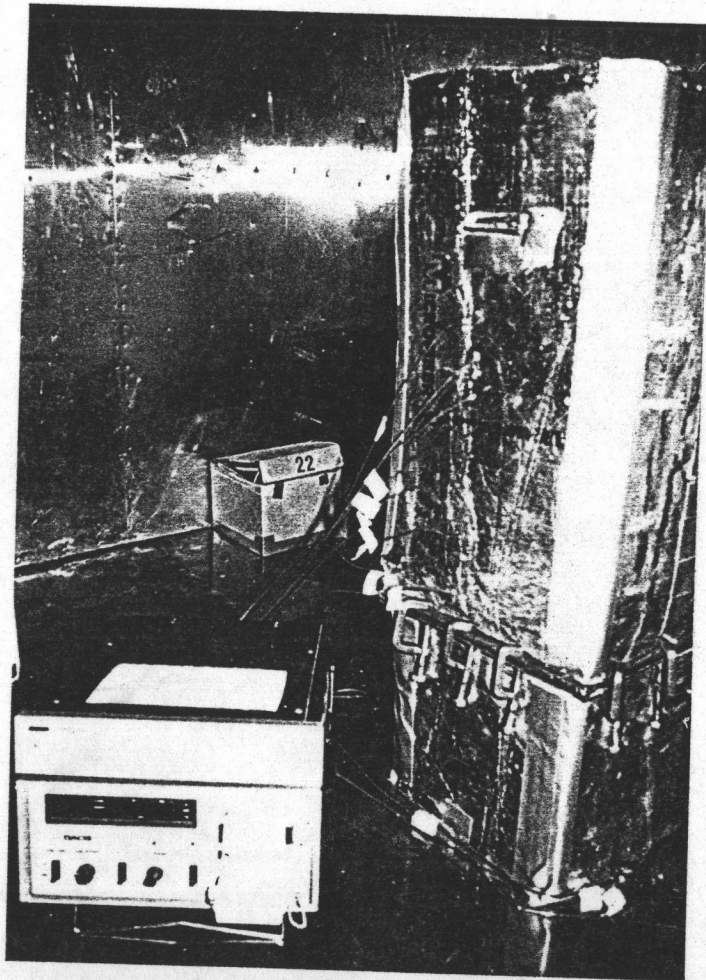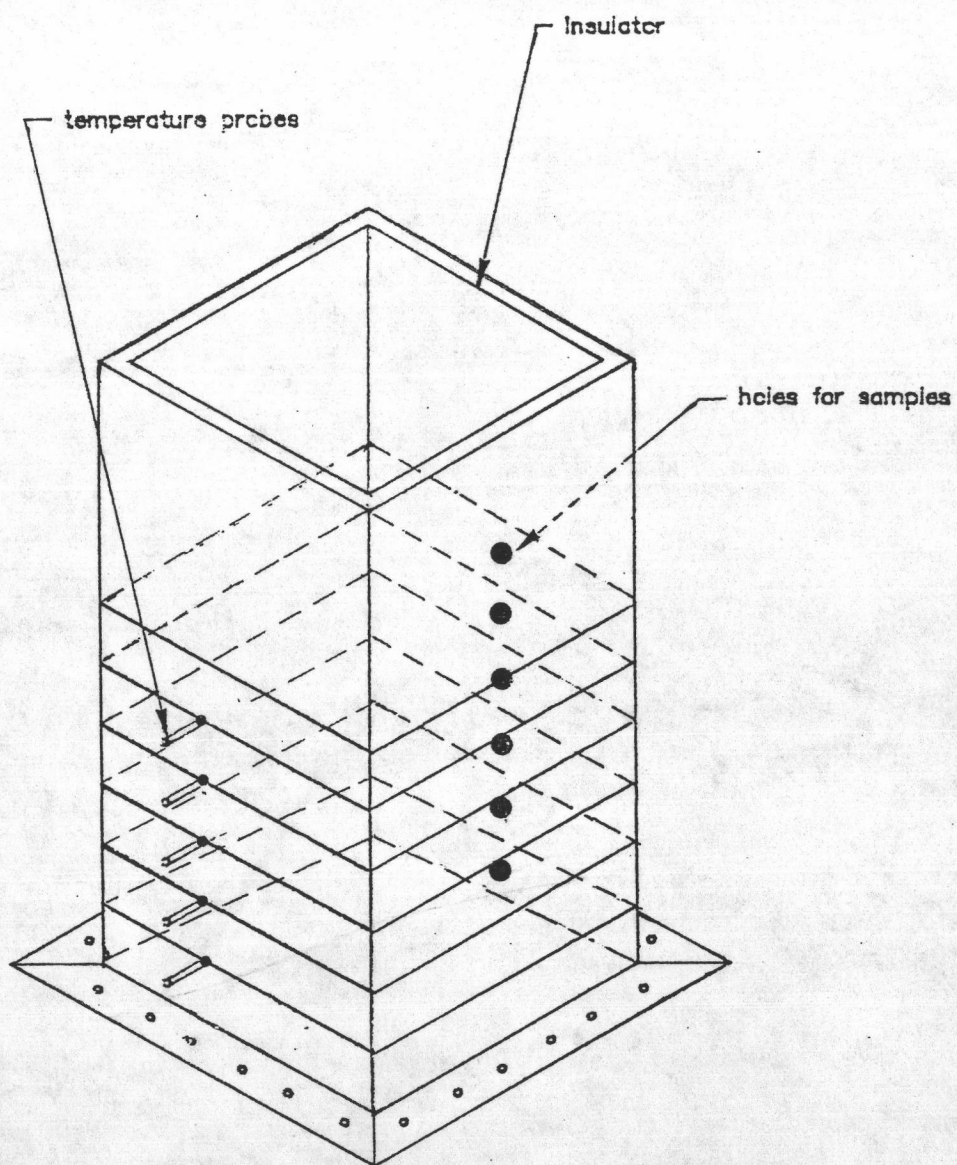| Experiment	1	2	3	4	5
Bed depth, m	0.3	0.3	0.3	0.3	0.3
Initial moisture content, % D.B.	29.32	30.36	26.31	34.53	32.54
Drying air temperature, $^{\circ}$C	44	33	43	53	38
Relative humidity,%	36	60	36	23	50
Air flow rate, m^3/sec.m^2	0.43	0.62	0.35	0.67	0.54

Figure 4.1   Photograph of deep bed dryer

Figure 4.2 Schematic of deep bed drying bin